THE IRON TRADE REVIEW

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High Prices for Prompt Delivery

Premiums Freely Paid on Plates, Shapes and Bars—Pig Iron Demand Continues and Quotations Are Higher in Leading Centers

THE Steel Corporation and leading independents continue to quote 1.60c, Pittsburgh, on shapes, plates and bars, but they do not guarantee any delivery, and for prompt delivery independent companies are having no difficulty in obtaining handsome premiums, the usual quotation for immediate shipment being 2c, Pittsburgh. Prices of other finished materials are also advancing. The recent advance of $1 per ton in wire products makes the quotations on those products the highest since 1909.

Pig Iron

Deals in eastern Pennsylvania have involved about 20,000 tons of basic and supplemental orders for various grades placed in New York make a considerable tonnage. There has been fair activity throughout the central west and prices are strong. In Chicago, $17.50 is now the minimum on foundry, malleable and basic. Quotations at Cleveland have been pushed up 50 cents and in the south the only iron obtainable as low as $13 is some resale tonnage which was bought a number of months ago at about $10. Prices in southern Ohio have been advanced to a basis of $16.50, Ironton, for No. 2.

Iron Ore

Under the leadership of the Pittsburgh Steamship Co., ore shippers have contracted for about all the lake vessel tonnage available to carry ore for next year's delivery at 50 cents per ton, an advance of 10 cents over this year's rate. The activity of the Steel Corporation was unexpected and was quickly followed by other companies. Opinions differ as to whether there will be enough vessels to transport the 50,000,000 or more tons which will be required to meet the demands of the blast furnaces.

Bars

For large rounds, as high as 4 cents per pound has been paid and numerous transactions, involving large tonnages, have been made at somewhat lower prices. Ordinary steel bars for domestic consumption have been sold as high as 3c. Companies quoting 1.60c, Pittsburgh, are not able to give deliveries on large sizes in less than six months and on small sizes in less than three months.

Plates and Shapes

The 11,000 70-ton cars for which the Pennsylvania railroad is now inquiring will require 220,000 tons of plates and shapes in their construction. Ore-handling companies have been advised that these cars will be used next year in the ore traffic and that all trestles must be strengthened to insure safety. Cleveland mills are having no difficulty in obtaining 2 cents for plates.

Machinery

Buying of equipment by manufacturers of munitions has been a very active feature of the machinery market during the past week, a Rochester company being among the heavy buyers in placing an order for about $200,000 worth of equipment. The principal output of the company will be 9-inch howitzers. The export demand continues heavy, but is not as active as in past months. Buying of equipment for plant extensions is very active at Pittsburgh and New England plants are also taking a great deal of machinery for additions to their capacity.

Sheets and Tin Plate

The American Sheet & Tin Plate Co. and independent companies announced the price of $3.60 per box for tin plate for next year's delivery. This is an advance of $8 over the price of last year, but is justified by the advances in sheet bars and tin. Mills have not been aggressive in trying to sell at the new price, but there are no indications of shading. There is considerable irregularity in prices of sheets, but no weakness. Advance in spelter is again an important factor in the price of galvanized sheets. The scarcity of forging billets is more pronounced and $50 is freely paid. The demand for bessemer steel in billets and sheet bars is more active and prices vary little from those commanded by open hearth steel.

THE OPEN HEARTH

Unusual Conditions in Iron Ore

CONFIDENCE in the continuance of prosperity next year was shown last week, when leading ore shippers unexpectedly came into the market and contracted very heavily for vessel tonnage in 1916, at 10 cents over the 1915 rate, which was based on 40 cents from the head of the lakes. It is difficult to find a precedent for this action. Naturally the year 1900, when Mr. Rockefeller, in order to establish the rate for Carnegie ore, kept his own fleet tied up throughout the season and chartered tonnage at $1.25, is recalled, but that action was due to competitive practices of those days rather than to the real demands of commerce. Business conditions of 1900 could not be compared to those of the close of the present year. The chartering which has already been done indicates a movement of at least 50,000,000 tons next year and some men in the ore trade say there will be no difficulty in moving 55,000,000 tons, but other shippers doubt whether that can be accomplished.

The chartering of vessels to move ore next year has aroused some discussion concerning ore prices. Recently a number of furnace operators who had not covered for their full ore requirements for this year have been trying to buy some additional ore, but without success. There has not been, however, any effort to force the ore market for next year and the ore men hope that there will not be. While 50 cents has been the advance most frequently talked about, $1 is now often discussed, owing to the very active demand for iron and steel products and the increased cost of mining. Only twice in the history of the ore trade has a buying movement been started as early as the present time; that is, the buying movement for 1907 was inaugurated on Nov. 5, 1906, and that for 1913 on Nov. 19, 1912. Four times in the last 26 years the buying movement has started in December; that is, in 1889, 1899, 1905 and 1909.

Increasing Popularity of Duplexing

ONE OF THE problems facing steel producers with increasing insistence is the growing demand for open hearth steel and the comparatively smaller demand for bessemer. In markets like the present, when steel is demanded in larger volume than it can be produced, it happens that with open hearth facilities taxed to the utmost, bessemer equipment is carrying only a partial burden.

One means of meeting this situation is in the duplex process, where direct iron is blown in the converter, the silicon and carbon being removed in large measure, and the material then is finished in the open hearth.

This gives a plant great flexibility in many ways. It allows the plant equipment to produce bessemer or open hearth tonnage, as desired, and makes the company less dependent on scrap supply. Another feature is the possibility of using pig iron made from ores of higher phosphorus content, because the phosphorus can be removed by the open hearth, but not by the bessemer process.

The trend toward the use of open hearth steel instead of bessemer is shown in the statistics of steel ingot production. In 1908, the output of bessemer ingots was 6,609,017 tons and of open hearth ingots 2,230,292 tons. In 1913, bessemer ingot production had grown only to 9,545,706 tons, while open hearth ingot production had increased to 21,599,931 tons. In 1914, bessemer production was 6,220,846, while open hearth was 17,174,684 tons.

In the present congested condition of the steel market, the only idle capacity of the United States Steel Corporation is said to be in bessemer plants, the open hearth capacity being strained to its utmost in the effort to keep abreast of the demand.

Construction of a duplexing plant has been started at the South Chicago plant of the Illinois Steel Co., to make available the output of the bessemer plant as open hearth steel after being duplexed. A duplexing plant will also be installed at Gary. Other work along this line in older plants probably will follow and thus the plants be made available for the production of either form of steel as the demand may arise.

Looking for Information

THE VOLUMINOUS questionaire which is being sent out by the federal trade commission in regard to the extension of foreign trade covers a great deal of ground and evidently is planned with the idea of bringing out all the information possible concerning the many features of foreign trade involved.

Considerable space is devoted to questions relating to the present law, especially as to whether all combinations to engage in export business are prohibited. The opinion on this subject of the average layman would not be of great value and perhaps for this reason one of the questions is—Is your belief based on advice of counsel? Doubtless many business men have consulted attorneys as to whether it would be legal to combine to engage in foreign trade and if these questions are frankly answered, the commission will have a large variety of opinions from lawyers and others.

As to the advantage of combination or co-operation in selling for export trade, full information is desired

THE OPEN HEARTH

and it is probable that the principal answer which will be received will be that it is almost impossible for a small concern to engage extensively in foreign trade. Organization of a high grade is positively required and that cannot be conducted without the expenditure of much money and energy. The commission wishes to know whether such combinations, solely for export business, would be in the interest of the public. Of course they would be, if properly conducted, as they would cause a very important extension in American business. Questions as to whether the combinations should be open to all manufacturers in the United States or only to all American-owned concerns, or be restricted to trade in noncompeting products, relate to details about which there will probably be differences of opinion. The fear suggested by one question that these proposed export organizations might be used to restrain trade in the domestic market is rather far-fetched.

The commission desires full information relating to foreign cartels, syndicates and combinations whose competition is encountered by Americans. Probably the answers will throw some light in this direction, for certainly it is true that foreign organizations, particularly those of Germany, have resulted in increasing the competition and in extending trade of foreign countries in the United States.

The commission has ahead of it a big task in making a digest of the thousands of answers that will be received, but if the questionaire results in obtaining a general expression from business men, the efforts of the commission will be well worth while.

The Helping Hand

A BRIEF paragraph in an Indiana newspaper told about the action of a steel mill in that district in giving each of its employes a bushel of apples. There has been an abundant crop of this fruit, the market is flooded and the growers are facing a considerable loss. Recognizing the condition as serious, this concern promptly bought 1,500 bushels for its workmen.

Following closely upon the heels of this story comes the information that a Cleveland concern has made arrangements for the purchase of a large quantity of potatoes for its men.

Even in this busy day and age, where big deals and mammoth contracts are occupying the time and thought of the "big" men of commerce, little acts of kindness are frequent. They are not done with the thought of creating favorable public opinion or in the hope of commendation, neither is the item entered upon the books as a politic expense. It is but the fulfillment of a fundamental law of humanity, which finds its highest form of expression in the bringing of happiness to others.

Wasting Valuable Deposits

AT THE recent dedication of the mines building of the School of Mines of Pennsylvania State College, H. M. Chance, consulting mining engineer, of Philadelphia, delivered an address on conservation of mineral resources. He said that conservationists have compiled estimates of waste that are astounding, for they tell us that in the production of 500,000,000 tons of coal annually, there is wasted and lost annually about 200,000,000 tons; that in the making of coke, combustible gases are wasted capable of producing 100,000,000 horsepower annually; that 20 or 30 per cent of the copper contained in copper ores mined and treated is lost, amounting in value to many millions of dollars annually; that in metallurgical treatment of ores and in the reduction of ores to metal there is annually lost and wasted other metals, amounting in value to many millions of dollars and that "similar losses might be shown to extend to and to include all mining and metallurgical industries." The last sweeping statement certainly is not true, so far as iron ore mined and the manufacture of iron and steel concerned. The iron business must plead guilty to being connected with great wastage in the making of coke, but the rapid extension of the by-product process is greatly reducing the waste of gases. In the mining of ore and the manufacture of iron and steel, the wastage is almost negligible.

Mr. Chance undertakes to defend the leaving of coal as pillars to support roofs in mines, because, he says, coal has a nominal value of but 10 to 15 cents per cubic yard and no labor value, because no labor has been expended upon it. He says that this use of the coal represents the cheapest and least valuable material available to support the roofs and saves the whole labor cost of building supports of other materials. So far as the present value to the world is concerned, this statement is true, but we do not believe that sound economics would justify the leaving in the ground of tremendous tonnages of coal, which in future years would be of great use to mankind. Due consideration for the people who will inhabit the earth in future years demands that none of the earth's valuable deposits which can be utilized with reasonable expenditure shall be put out of the reach of mankind. Coal promises to be one of the most precious of the deposits in future years and its strict conservation should be insisted upon and required by public officials.

Prices Present and Past

Quotations on leading products November 17, average for October, 1915, average for August, 1915, and average for November, 1914. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Nov. 17, 1915.	Aver. for Oct., 1915.	Average for Aug., 1915.	Aver. for Nov., 1914.
Bessemer pig iron, Pittsburgh..	$17.95	$16.95	$15.89	$14.70
Basic pig iron, Pittsburgh.....	16.95	15.95	14.89	13.45
No. 2 Fdy. pig iron, Pittsburgh	16.95	15.57	14.70	13.70
Northern No. 2 Fdy., Chgo....	17.50	14.44	13.38	13.00
Lake Superior Charcoal, Chgo..	17.25	16.25	15.75	15.75
Mall., Bess., Chgo.....	17.50	15.12	13.38	13.00
Southern No. 2, Birmingham...	13.00	11.87	11.25	9.88
Southern Ohio No. 2, Ironton..	16.50	14.88	14.25	12.63
Basic, eastern Pa.....	17.75	17.50	15.25	13.50
No. 2X Virginia furnace.....	14.50	13.75	12.75	12.50
No. 2X foundry, Philadelphia...	17.00	16.25	15.00	14.25
Ferro mang., Balti., (prompt)..	98.00	105.00	100.00	68.00
Bessemer billets, Pbgh.....	28.00	25.50	23.00	19.00
Bess. sheet bars, Pbgh.....	28.00	25.50	24.00	19.50
Op.-h'th sh. bars, Pbgh.....	29.00	26.50	25.00	19.50
Open-hearth billets, Pbgh.....	29.00	26.50	24.00	19.00
Steel bars, Chgo.....	1.79	1.59	1.49	1.25
Steel bars, Pittsburgh.....	1.75	1.41	1.30	1.10
Iron bars, Philadelphia.....	1.759	1.55	1.40	1.15
Iron bars, Cleveland, local del'y.	1.50	1.39	1.22	1.20

	Prices Nov. 17, 1915.	Aver. for Oct., 1915.	Average for Aug., 1915.	Aver. for Nov., 1914.
Iron bars, Chgo. mill.....	$1.50	$1.37	$1.23	$0.98
Beams, Chgo.	1.79	1.59	1.49	1.25
Beams, Pittsburgh	1.75	1.41	1.30	1.10
Beams, Philadelphia	1.859	1.559	1.459	1.25
Tank plates, Pittsburgh.....	1.75	1.42	1.30	1.07
Tank plates, Chicago.....	1.79	1.55	1.44	1.25
Tank plates, Philadelphia.....	1.859	1.559	1.459	1.25
Sheets, blk., No. 28, Pbgh.....	2.30	2.05	1.83	1.85
Sheets, blue an., No. 10, Pbgh.	2.00	1.60	1.36	1.35
Sh., galv., No. 28, Pbgh.....	3.70	3.50	3.93	2.85
Wire nails, Pittsburgh.....	1.90	1.76	1.61	1.55
Connellsville fur. coke, contr....	2.50	2.25	1.75	1.69
Connellsville fdy. coke, contr...	3.00	2.48	2.25	2.25
Heavy melting steel, Pbgh.....	15.50	14.00	13.38	10.30
Heavy melting steel, east'n Pa..	14.50	14.50	13.50	9.50
Heavy melting steel, Chgo.....	14.00	11.56	11.50	8.25
No. 1 wrought eastern Pa.....	17.00	16.00	14.50	11.50
No. 1 wrought, Chgo.....	13.00	10.68	10.12	7.50
Rerolling rails, Chgo.....	14.50	13.25	11.75	9.50
Car wheels, Chgo.....	12.50	11.75	11.38	10.00

(For Additional Prices See Page 1010.)

Pig Iron Market is Very Strong

Buying of Fair Tonnages Continues—Prices Higher at Chicago and Cleveland—Basic Sold in the East

Philadelphia, Nov. 16.—General activity is maintained in pig iron buying in this territory. Foundry iron now is in good demand and is catching pace with the steelmaking grades. Trade deal purchases of basic iron have been a new feature, these totaling 15,000 to 20,000 tons at prices ranging about the equivalent of $17.50 to $17.75, delivered eastern Pennsylvania. A Lebanon, Pa., steelmaker has inquired for 10,000 tons of first quarter basic. Low phosphorus has gone to $30, furnace. Lebanon makers have sold at that figure and a leading eastern Pennsylvania producer of standard iron now is quoting $30, furnace, while a second maker of this grade is out of the market. Buying is liberal, sales of this week totaling 15,000 to 20,000 tons. A New Jersey steelmaker took upwards of 8,000 tons. Canadian buyers continue to clamor for this grade and cannot fill all their early needs. One consumer there asks 2,000 tons. Northern foundry iron is higher and $17.25, Philadelphia, for No. 2X is becoming the minimum for this year and $17.75 for first quarter. Virginia metal is strong and active around $15, furnace, for No. 2X. The Baldwin Locomotive Works closed for 7,000 tons of two foundry grades; a Wilmington buyer for 1,000 tons, and a Reading shop for 1,000 tons. A sale of 1,500 tons of No. 2 plain first quarter was closed at $16.75, eastern Pennsylvania furnace. Two Lynchburg, Va., pipe works have taken about 20,000 to 25,000 tons of low grade iron from Virginia and southern makers. There has been some recent buying of pipe and puddling forge in this district at $16.25 to $16.50, delivered, and some sales of the latter were done at higher prices. Malleable, after recent sales, now is about $18 to $18.50, delivered, this district. The Topton, Pa., furnace will resume about Dec. 1.

Supplemental Orders

New York, Nov. 16.—A number of eastern buyers who already had closed on their maximum requirements of iron for shipment up to Jan. 1, have been making supplemental purchases as a protection against possible shortage wherever comparatively favorable prices are tendered. This has been particularly in evidence in New England districts and Virginia makers, by reason of their being able to offer the most attractive prices at present, have taken the bulk of this business. At the present schedule of $14.50 to $15, furnace, for No. 2 plain, quoted by leading Virginia makers, New England prices of from $17.75 to $18.25, delivered, are possible and the buying has been within this spread. One consumer took 2,000 tons. The Washburn Wire Co., Phillipsdale, R. I., which was asking for 5,000 tons of basic, is understood to have closed, but it is thought that the Eastern Malleable Iron Co., which recently opened negotiations for a round block of malleable, has not taken action in view of the prices named. In the immediate metropolitan district, buying is moderate. An Elizabeth, N. J., consumer has asked for 2500 tons of foundry. Eastern Pennsylvania furnaces now are quoting from $16.50 to $17, furnace, for No. 2X, for this year and first half, or about $17.25 to $17.75, tidewater. A sale of 1,000 tons of Buffalo No. 1X for first half at $17, furnace, is noted. This said grade for export has been done at $17.50, furnace. Some good-sized export lots are open, but freights are high and over 65s to Genoa and Mediterranean points is ruling.

1916 Ore Price Discussed

Pittsburgh, Nov. 16. — Carrying charges on Lake Superior iron ore

(*For complete prices see page* 1010.)

having been advanced 10 cents per ton for 1916 shipment, making the rate to the consumers 50 cents from the head of the lakes, talk is heard of an advance of $1 a ton for ore. It is reported that practically all the ore carrying vessels have been engaged and fear is expressed that a shortage of ore may be experienced. It is predicted that a total of 60,000,000 tons of iron ore will be shipped down the lakes next season if necessary vessel space can be chartered. Some merchant vessel interests may not contract to carry cargoes up the lakes, preferring to use their facilities for their own interest entirely.

The pig iron market in western Pennsylvania is quiet, but prices are hardening on all grades. Basic, foundry and malleable iron are being held firmly at $16; bessemer at $17 and gray forge at a spread of $15 to $15.50, valley. Some iron has been obtained this week at less than those figures, through offers made 10 days or a fortnight ago. The Pressed Steel Car Co. has closed for 6,000 tons of malleable iron for first quarter delivery at a shade under $16, valley. Rather heavy tonnages of bessemer iron are involved in several pending inquiries. Fannie furnace at West Middlesex, Pa., has been blown in on basic iron. Ella furnace, at the same point, also is running on basic iron.

Market Strong—Interest Keen

Buffalo, Nov. 16.—While the actual bookings of the past week have not been as large as during the previous week, the interest seems to be growing materially. Buyers are becoming anxious regarding the ability of the furnaces to fill their advanced requirements. The demand for all kinds of iron under contract is increasing. The pressure is taxing the capacity of the largest producers to keep their customers supplied.

Prices in the district remain at the figures quoted a week ago covering a range of $16.50 to $17.50, according to grades. One interest that is virtually sold up over first quarter and into second quarter is holding for a minimum of $17. This interest is entirely out of the market for high silicon grades, having exhausted its yard stocks. If any shading has taken place in the $16.50 price. it has been in connection with but a few sales of low grades. Prices are being held firmly and the indications are that a further advance will be effective in a brief space of time.

The demand for special grades of iron is greater than has ever been experienced by some of the larger interests, particularly the high silicon silvery iron, the bessemer ferro-silicon and low phosphorus grades. The demand seems to be in excess of the supply. A sale was made during the week of a special grade of high silicon iron at nearly $35 per ton at the furnace in Ohio.

Several of the interests report that they are pressed to such an extent for material under contract that they could ship double the amount they are able to make.

Cleveland Price Advanced

Cleveland, Nov. 16.—While no large tonnages of pig iron have been sold by Cleveland furnaces during the past week, steady demand has continued, and, owing to this fact and the strength of the valley situation, the Cleveland price has advanced to $16.50 for No. 2 foundry and malleable. There is still a little shading of $16, valley, on No. 2 foundry, which is rather remarkable in view of the general strength of present conditions and it seems probable that higher prices will prevail.

Stronger at Youngstown

Youngstown, O., Nov. 16.—Increasing strength features the pig iron market. While most furnaces have booked considerable tonnage for delivery through the first half of next year, inquiry for moderate-sized lots of iron continues heavy in the aggregate. Consumers seem to have abandoned the hand-to-mouth policy which has characterized the market for many months and are building up their stocks.

A local maker recently sold 1,000 tons of bessemer pig iron for delivery this year, at $17.50, valley. It is believed no bessemer iron now is available under that figure, while an advance of 50 cents a ton has been asked for first quarter delivery. Several brokers' inquiries for bessemer iron are in the market, calling for about 10,000 tons each. It is not known definitely whether these are for export or speculative purposes. As high as $20, valley, has been asked on export business. The rumor that a prominent middle western consumer is in the market for 100,000 tons of bessemer pig iron is officially denied.

Foundry and malleable prices also are higher. Sales of No. 2 foundry have been made at $16.50, valley.

Pig Iron Still Advances

Chicago, Nov. 16.—Steady advances of quotations of northern pig iron, foundry, malleable and basic, mark the Chicago market. A minimum of $17.50, furnace, is now well established and sales are heard of at $18 to $18.50, Chicago furnace. These latter seem to have some special consideration attached which brings the higher price. Inquiry is fair, but as most melters seem well covered for their requirements through first half, further tonnage is scattering and does not come in lots of more than 1,000 tons each. For the most part, inquiry is for smaller tonnages.

With the small available capacity unsold through first half, the possibility of $20 iron is not so remote as a few weeks ago and even should this level be attained only after production is entirely contracted, it will offer an attractive basis from which to work in making quotations for second half iron. No inquiry is stirring yet for iron after July 1, but the present tendency of the market seems likely to bring it out much earlier than usual.

Lake Superior charcoal iron continues steady at former quotations, a range of $17.75 to $18.75, delivered, Chicago, being quoted by the principal producer, while prices 50 cents under this have been made recently by another maker. Considerable tonnages of charcoal iron have been sold, but at present a lull in selling this grade is apparent.

Southern iron is available at $13.50 to $14, Birmingham, for any delivery to July 1. Some resale iron is a disturbing factor and less than $13.50, Birmingham, has been done within the past few days.

The second stack of the Bayview furnace of the Illinois Steel Co., at Milwaukee, was blown in Nov. 10, and produced its first iron Nov. 15. This stack was scheduled to go in blast about Dec. 1, but pressing conditions of the market brought about its activity much sooner than had been planned. The only remaining stack likely to become active in this territory this winter is the second Federal stack at South Chicago, which will be lighted Dec. 1.

Pig Iron Advances

Cincinnati, Nov. 16.—Southern Ohio No. 2 foundry iron has been advanced to $16.50, Ironton basis, for this year and the first half of 1916. Basic and malleable iron are very scarce, and are being held at about the same figure as foundry iron. Silvery iron, which has been advancing very rapidly during the past three weeks, is now quoted at from $22.50 to $23, furnace, for 8 per cent silicon. Bessemer ferro-silicon has remained for a week at $25, furnace, for from 10 to 11 per cent. Southern furnace iron is now strong at from $13.50 to $14, Birmingham basis, for No. 2 foundry, for first quarter shipment, and several sales have been made recently at

(*For complete prices see page* 1010.)

the higher figure. A small amount of southern resale iron is being offered here at $13, Birmingham basis, for immediate delivery only, and at $13.50 for the first quarter of next year. Inquiries are very scarce and sales are lighter than at any time for more than a month, but strength of quotations and of the market in general is becoming more apparent each day. The only transaction of importance pending is with a local melter who is out for 800 tons of southern foundry iron.

General Improvements

St. Louis, Nov. 16.—There has been quite a marked improvement in all lines of the iron industries in this district within the last week, and local sales agents are very optimistic concerning the future. Inquiries out are for 1,000 tons of southern car wheel iron, 1,000 tons of northern car wheel iron, 1,000 tons of malleable and scattering lots amounting to perhaps 1,000 tons. Sales last week perhaps amounted to 2,500 tons, including 1,000 tons of southern No. 2 and 150 tons of high silicon, which changed hands Saturday. Southern No. 2 is held at $14 for first quarter delivery and $14.50 for second quarter delivery, f. o. b. Birmingham. Northern iron is quoted at $17.25 to $17.50, Chicago, and $16.50 to $17, Ironton.

Vessel Tonnage Chartered

Ore Shippers Make Contracts for Hauling for Next Year at an Advance of Ten Cents

Not since 1900 when John D. Rockefeller in order to establish the going rate for Carnegie ore tied up his own fleet all season and chartered tonnage at $1.25, has such a situation existed on the lakes as is existing today. The leading ore shippers came into the market Friday last and chartered very large lots of tonnage at 10 cents over the 1915 rates, making the rate net to the ship for 1916 delivery 50 cents from the head of the lakes, 45 cents from Marquette and 35 cents from Escanaba. In their eagerness to cover their requirements they chartered pretty close to the capacity of some of the independent fleets. As this chartering was done before ore prices were established or sales made, it exhibits a sublime faith in the continuance of the present demand for iron and steel products. Vessel owners, in fact, would have been quite satisfied to obtain an advance of 5 cents over the 1915 rate, but such is the cupidity of human nature that some of them are now maneuvering for even better than 10 cents. Tonnage has been slow in coming out during the present week and some of the owners are endeavoring to withhold capacity in the hope of doing even better by running wild. However, the amount covered is sufficient to guarantee a movement of 50,000,000 tons during 1916, and while ore shippers some time ago would have liked to close up this season's business before tackling that of next year, it is now probable that the business of 1916, including ore sales, will have been made before the new year.

While the talk some time ago was of a 50-cent advance in ore prices, the general figure now mentioned is $1. The dock stock piles are being attacked and ore that has been so long on hand as to be entirely covered with vegetation is now being moved to the furnaces. The docks in all probability will be cleaner next May than they have ever been.

November ore shipments will show a falling off due to unforeseen obstacles attending fall navigation. Thick weather has delayed the fleet considerably, but the most serious of all delays have been the constant strandings at the lower end of the St. Clair ship canal. Vessels are most inconveniently fetching up there, and on Tuesday both upbound and downbound channels were blocked, bunching about 70 steamers above and below the canal.

An Experiment

Chicago, Nov. 16. — Shipments of iron ore from deposits near Waukon, Ia., are being made to South Chicago, where the ore will be used in the Iroquois Iron Co.'s stacks as an experiment. Possible shortage of Lake Superior ore has led the company to seek a reserve supply from Iowa and supplies will be made at once to determine the practicability of its use in ordinary practice. Several thousand tons have been contracted for and shipments are being made steadily. The ore is said to be not unusual in any respect as to analysis, and expectations are that it will work satisfactorily.

The Lackawanna Iron & Steel Co. has lighted one of its twin Colebrook furnaces at Lebanon, Pa.

(*For complete prices see page* 1010.)

Bessemer Billets

Large Tonnage is Bought by a Pittsburgh Consumer

Pittsburgh, Nov. 16.—A local steel manufacturer, having open hearth steel capacity, during the last few weeks has closed for about 40,000 tons of bessemer billets, which will be furnished by several producers. It is understood the material was obtained at prices prevailing a fortnight ago. The purchase of this tonnage releases some open hearth steel material, but the general situation is not affected. The Carnegie Steel Co. is asking $28 for billets and $30 for sheet bars at either Pittsburgh or Youngstown. Forging billets are selling at a wide range in price, with $40 as the minimum quotation. Wire rods are being quoted at $37, Pittsburgh, by some concerns, but no trace of sales can be found. More important manufacturers say they are not offering material in the open market.

Tight at Youngstown

Youngstown, O., Nov. 16.—Each week sees the semi-finished steel market wound up more tightly. Replacement of open hearth steel for bessemer steel in various channels of domestic trade, where such shift is practical, has placed both grades on about the same level, $28 for billets, $30 for sheet bars, Youngstown, delivery this year. These prices are nominal. In more than one case recently, open hearth steel producers have bought bessemer steel to operate their finishing mills, diverting their open hearth output to other purposes.

Paying High Prices

Cleveland, Nov. 16.—Cleveland consumers of forging billets are paying $50 per ton for moderate tonnages. This remarkably high price is paid without much complaint, as consumers are glad to get the steel at any quotation.

Rivet Price Holds

Pittsburgh, Nov. 16. — Despite sharp advances registered by steel rivets the last 60 days, manufacturers in this district express confidence that no difficulty will be experienced in establishing new quotations, when buying for future delivery is resumed. Activity has been augmented to some extent by the buying of material for export. Domestic buying has not been heavy enough recently to test prices.

The 1,000-ton metal mixer being installed at the New Castle, Pa., plant of the Carnegie Steel Co. will be completed Jan. 1.

Bar Prices Are Climbing

Prospect of 4 Cents Being the Quotation for Large Rounds—Contracts for Explosive Shells

Philadelphia, Nov. 16.—Large rounds were sold this week by a leading producer at 4c, mill. The demand for all kinds of bars is heavy with large rounds still the leader. Makers are turning down business right and left even from regular customers and find it necessary to set aside for first quarter, only a small proportion of the tonnage which individual buyers are asking that they be covered upon. An important Lebanon buyer asking 1,000 tons of rivet rods and 300 tons of nut steel did not receive a single quotation. Some makers now are promising July shipments on some sizes. The Carnegie and Cambria Steel companies formally have adopted a 1.70c or 1.859c, Philadelphia price, and other makers now are coming up to this figure.

Market Active

New York, Nov. 16.—A price of 4.00c, mill, for large rounds for shell manufacture is in sight, according to present indications, as the demand for this material, shell forgings, etc., remain very active. Sizeable tonnages were closed the past week at between 3.50c to 3.75c, eactern Pennsylvania mill. One maker in that locality completed the final arrangement on a lot of 25,000 tons of rounds and booked additional orders of 10,000 tons of rounds and about 15,000 tons of forging steel for 8 to 9-inch shells. Some other important lots were closed in this market. The American Steel Foundries has been one of the recent buyers of steel against its recent shell contract, while the American Brake Shoe & Foundry Co. has received a contract for about $10,000,000 of 9-inch high explosive shells for the British government. The American Locomotive Co. has purchased 10,000 tons of steel for shell manufacture from a western Pennsylvania maker at a reported price of 3.50c, mill.

Bar Iron Advanced

Philadelphia, Nov. 16.—Eastern Pennsylvania workers of bar iron have advanced prices to 1.60c, Pittsburgh, or 1.759c, Philadelphia. Business is active.

Bar Iron Advances

Chicago, Nov. 16.—Makers of bar iron in Chicago have advanced quotations to 1.50c, Chicago mill, for this year's delivery and 1.55c, Chicago mill, for first quarter. Under present circumstances it is not believed these quotations will hold long.

Inability to obtain steel for any reasonable delivery is throwing considerable tonnage to bar iron makers and as time progresses it is believed this condition will be accentuated.

Mills in this district are working well toward capacity and specifications are being received for considerable tonnages steadily.

Market Tight

Chicago, Nov. 16.—The market for steel bars is featureless except for the efforts of consumers to obtain tonnage from makers. Larger mills and many of the smaller are practically sold out for months in advance and quotations are nominal at 1.79c, Chicago. Occasional small tonnages which chance to fit rolling schedules are sold from time to time, but practically nothing remains available for the consumer.

Bars Sold at 3c.

Cleveland, Nov. 16.—Several hundred tons of ordinary steel bars have been sold in Cleveland within a few days at 3c a pound. Leading independent companies are taking orders very conservatively for any delivery. The Carnegie Steel Co. is still quoting 1.60c, but will not guarantee delivery and it is probable that delivery on large sizes would be delayed six months and on small sizes three months.

Bars Continue Active

Pittsburgh, Nov. 16.—While demand for bar steel is tremendous, yet the market is not nearly so excited as it was a few months ago. Large orders for shrapnel rounds are being received almost daily. Shrapnel stock is selling at as high as 3.50c, and indications are that the market will advance to a 4c basis shortly.

Hoops, Bands and Shafting

Pittsburgh. Nov. 16.—The 55 per cent off the list price of steel shafting, adopted a week ago, has been established. Shafting makers are not in a position to promise additional tonnage before July 1. Some of them are unable to obtain desired tonnages of rounds, because of the congested condition of rolling mills.

Steel bands are being offered at 1.75c and hoops at 1.60c. Demand for both products is heavy. Three-eighths inch proof coil steel chain has been advanced $1 a ton and now is being held at 3.30c base. Thirty days ago, chain was offered at 3.05c.

(*For complete prices see page* 1010.)

Ferro Buying

Is Not Very Active Owing to Promises of Better Shipments

New York, Nov. 16.—Consumers of ferro-manganese continue to buy this metal only in a scattered and moderate way, as the promised condition of better shipments from England from this time forward seems to have influenced them to act conservatively at the present prices. At the moment, inquiries for about 500 tons, chiefly for prompt shipment, are pending here. A consumer in the Youngstown district who asked for 1,200 tons for first quarter has withdrawn this inquiry, temporarily. Prompt ferro-manganese continues irregular in price and the spread stands at about $98 to $100, seaboard, although reports of lower than the inside figure still are current. Sellers here report carload lots for early shipment booked in the week at $100, seaboard. On first quarter and first half contracts, $100, seaboard, remains commonly quoted.

Some selling of domestic spiegeleisen is being done at the unchanged range of $28 to $30, furnace, for 19 to 21 per cent.

Alloys and Metals Still Active

Pittsburgh, Nov. 16.—Demand for ferro-manganese, 50 per cent ferro-silicon and bessemer silicon, continues decidedly active. Ferro-manganese does not appear so strong, but current prices are not being shaded. Several lots of spiegeleisen ranging from 500 to 1,000 tons have been sold at $28, furnace.

Pipe Demand Not Heavy

Pittsburgh, Nov. 16.—Manufacturers of iron and steel pipe are operating plants at not more than 75 per cent of capacity. Specifications for merchant pipe are coming out in fairly heavy volume, but buying of line pipe and oil country goods is not active. Manufacturers of boiler tubes are from six to 10 weeks behind in deliveries. Seamless tube mills have enough orders on their books to keep plants running at capacity until July 1. Considerable export business is being enjoyed by seamless tube makers.

Herbert Earl Merrow, president of the Merrow Machine Co., Salem, Mass., died Nov. 7 in the Salem hospital from injuries received in an automobile accident Nov. 1. Mr. Merrow was born in 1868.

Sheet Market Irregular

Many Complications Affect Prices—Advance in Spelter a Factor in Galvanized Product

Youngstown, O., Nov. 15.—The steel sheet market has been irregular for months, but never have the complications been so numerous as at present. The abnormal prices for spelter have been a main underlying factor in the market all year, tending to shift both demand for and production of galvanized sheets to black sheets. Just as galvanized sheet prices were becoming adjusted to a more nearly normal level, and demand from domestic consumers was beginning to revive, spelter prices again have shot upwards, a situation which galvanizers had not expected. In view of the increasing production of spelter, stocks in the hands of consumers have been allowed to become low. Now, in addition to the high spelter prices, sulphuric acid has become scarce and expensive, and many mills have no contracts for next year. Not less important, the scarcity of steel is furnishing sheet makers who buy their steel outside plenty of food for thought. Some of them have completed arrangements for the first part of next year, but many companies do not know what their steel will cost them. Under such conditions, most mills are not quoting on galvanized sheets, practically withdrawing from the market, and such quotations as are heard range all the way from 4c to 4.50c, Pittsburgh, for No. 28 gage, with actual sales reported at the maximum named. Some mills are quoting as high as 4.90c, Pittsburgh, for No. 28 gage, on business for export.

Blue annealed sheets and black sheets are almost as irregular as galvanized. Some makers are asking 2c and others 2.10c for No. 10 gage blue annealed sheets for delivery for both the remainder of this year and the first quarter of next. Demand for this description seems to be of even greater volume than before.

The market distinction between open hearth and bessemer steel sheets almost has disappeared, although some mills are asking a premium of about $2 a ton where open hearth is specified. The minimum of 2.30c, Pittsburgh, for No. 28 gage has not vanished completely, but most makers are asking 2.40c to 2.50c, Pittsburgh, for both this year and the first quarter of next. Premiums are being paid in some instances for spot shipment. Thus a carload was sold on a basis of 2.95c, Pittsburgh. Many sales have been made at 2.50c.

Prices Stiffen

Pittsburgh, Nov. 16.—Prices of all grades of steel sheet products have advanced sharply the last two weeks. Galvanized steel sheets are being held at 4c and above for No. 28 gage; black steel sheets are selling at a spread from 2.25c to 2.50c, with prices below 2.40c rapidly disappearing; blue annealed sheets are held at 2c for No. 10 gage. Production of galvanized material has been curtailed slightly, because of a shortage of sulphuric acid in which sheets are dipped to remove scales. Most sheet manufacturers have shattered all previous records this month in the receipt of specifications and orders.

Active Demand

Cleveland, Nov. 16.—The demand for sheets continues active and as high as 2.20c is being asked for No. 10 blue annealed, which is on the basis of 2c for plates.

Fluctuate at Cincinnati

Cincinnati, Nov. 15.—Prices of steel sheets are uncertain, and are fluctuating over an unusually wide range. The general situation is strong, but mills will not sell for extended delivery, confining transactions to prompt deliveries. Black sheets No. 28 gage are quoted all the way from 2.20c to 2.40c, and galvanized No. 28 at from 3.75c to 4c, all Pittsburgh basis. One mill in this territory is selling more sheet bars to eastern users than it is turning into sheets, because a better profit can be realized on its semi-finished product.

Sheet Market Quiet

Chicago, Nov. 16. — Sheet mills, in common with other finished steel producers, are well filled for some distance into the future and tonnage is difficult to place at any price. A nominal quotation of 2.44c, Chicago mill, for No. 28 gage black and 2.99c, Chicago, for No. 28 gage galvanized represents the market where tonnage can be obtained at any price. Some sellers are able to obtain higher prices in isolated instances to relieve pressing necessities.

Tin Plate Quoted at $3.60

Pittsburgh, Nov. 16.—The American Sheet & Tin Plate Co. on Nov. 11 opened its books on tin plate for shipment during the 1916 season on a basis of $3.60 per 100-pound box, 14 x 20 prime bessemer, f. o. b. Pittsburgh. The new price is $8 above that announced a year ago, when pig tin was quoted at 33.50c and sheet bars at $19.50. When books were opened this year, tin was listed at 38.50c and sheet bars at a spread from $28 to $30. The prevailing price is the same as that adopted Sept. 4, 1912. So far as can be learned, mills in this district are refusing to shade $3.60. An active buying movement is under way, although most manufacturers have not disposed of the bulk of their output for next year.

(*For complete prices see page* 1010.)

Wire Prices

Are Now Highest Since 1909—Domestic Demand Active

Pittsburgh, Nov. 16.—The American Steel & Wire Co.'s new prices are the highest to prevail since May, 1909. Most wire manufacturers in western Pennsylvania and eastern Ohio practically have withdrawn from the market, being unable to promise deliveries until the latter part of the first half of next year. The domestic trade shows considerable snap and exports continue heavy.

Wire Advanced $1

Chicago, Nov. 16.—An advance of $1 per ton on plain wire, barb wire and nails was put into effect Nov. 12 by the leading interest and plain wire is now quoted at $1.75, Pittsburgh, in carload lots to jobbers with wire nails at $1.90, Pittsburgh, on the same basis. Makers expect conditions will result in nails going to $1.90, Pittsburgh. The new price on painted barbed wire is 2.05c, Pittsburgh, with the usual extra of 70c per 100 pounds for galvanized barbed wire.

Another Warehouse Advance

New York, Nov. 16.—Another advance of $2 a ton has been put into effect in the warehouse schedule in the metropolitan district. Plates and shapes from store now are quoted at 2.30c, delivered, and steel bars at 2.25c.

Warehouse Figures Advance

Chicago, Nov. 16.—An advance of $2 per ton on finished steel products from store was put into effect the middle of last week placing steel bars at 2.10c, Chicago store, and shapes and plates at 2.20c, Chicago store. St. Louis and St.

Paul warehouse prices were advanced accordingly. No. 28 gage black sheets are now at 2.75c, Chicago store.

Slow deliveries from steel mills have furnished considerable business to warehouses and business is much brisker than at any previous time this year.

Cast Iron Pipe

Is More Freely Exported—Large Tonnage of Segments

New York, Nov. 16.—Export orders have figured more conspicuously in the week's business. The United States Cast Iron Pipe & Foundry Co. has taken 4,100 tons of 3-inch to 14-inch, including 2,500 tons of 14-inch for the Caibarien, Cuba, waterworks construction through the J. G. White Engineering Corporation and 1,250 tons of 6-inch and 10-inch for Honolulu. A considerable tonnage for Brazil remains in prospect. A large proposition, in which some of the pipe foundries are interested, is the offering of 42,000 tons of cast iron segments by the City of New York for a tunnel under the East river at Fourteenth street, for rapid transit construction. Bids are to be taken Dec. 7. The city is expected to pay a largely advanced price over similar contracts of the past year or two. Some private buyers of pipe more actively are considering their next year's needs and the most important inquiry of this kind is 3,800 tons of 4-inch to 30-inch for the Brooklyn Union Gas Co. The shops are quoting sharply advanced prices. The United States Cast Iron Pipe & Foundry Co. has 600 tons of 72-inch for Edgewater, N. J., and 330 tons of 4-inch to 12-inch for the Consolidation Water Co.; R. D. Wood & Co., 280 tons of 8-inch for New York City at $26, delivered, while the Central Foundry Co. finally was awarded the 1,000 tons of 6-inch to 8-inch for Peapack, N. J. The Donaldson Iron Co., Emaus, Pa., is low on 970 tons for New Bedford, Mass., at $25.80, for the 30-inch and $27.10 for the 6-inch to 10-inch.

Cast Pipe Steady

Chicago, Nov. 16. — Makers of cast iron pipe are on the threshhold of important business, but at present little tonnage is offering. Some contractors' tonnages are being figured on, but they are not of importance, and routine business is comparatively slack. Prices remain steady, but probably will advance shortly as pig iron gains higher levels.

The only letting of any noticeable tonnage is to be at Sandusky, O., Nov. 18, when figures will be taken on 600 tons of 12 to 24-inch pipe for sewer extensions.

Two Cents Paid for Plates

For Prompt Delivery, But Lower Quotations Are Made by Companies Not Able to Deliver Promptly

Philadelphia, Nov. 16.—In plates, 2c, Pittsburgh, now is an actuality in the eastern Pennsylvania district. A leading mill now is quoting that price or 2.159c, Philadelphia, on first quarter contracts, and has taken some business on that basis including one lot of 500 tons. For current business accompanied by specifications, 1.85c, Pittsburgh, is named. This maker's deliveries now are quoted 10 to 15 weeks. Other eastern plate makers are quoting from 1.60c to 1.70c, Pittsburgh. The Cramp ship yard is credited with having taken two more boats. The Lukens Iron & Steel Co. last week broke all records of production with a weekly output of 5,902 tons.

Plate Mills Sold Up

Pittsburgh, Nov. 16.—Heavy specifications characterizes the market for steel plates. More important manufacturers are not attempting to book additional tonnages for future delivery. While the 1.60c figure is being offered for shipment at the convenience of the mill, some makers are asking premiums of $2 and $3 a ton for anything like nearby delivery.

High Cleveland Prices

Cleveland, Nov. 16.—The Cleveland mills have advanced their quotations on plates to 2c for prompt delivery and are not taking any other kind of business. In fact, they are very conservative about taking orders, even at 2c. Eastern Pennsylvania mills are quoting from 1.90c to 2c for delivery in six to eight weeks.

Pay High For Plates

Chicago, Nov. 16.—Large makers of steel plates are out of the market and quote nominally 1.79c, Chicago, but some smaller independent mills have reserved some tonnage and are able to take specifications from consumers who are hard pushed and are willing to pay the price. Some transactions have been made at the convenience of mills at 1.99c, Chicago, and others for immediate delivery at 2.09c, Chicago. How long available tonnage of this sort will remain is a problem, but undoubtedly it will be filled before long.

Purchases Land. — The Cleveland Galvanizing Works Co., Cleveland, has purchased 19 parcels of land adjoining its plant, which will permit of making large extensions in the near future. The company manufactures a line of weldless wire chain, sash chain, etc. The property has a Pennsylvania railroad siding and fronts on four streets.

(For complete prices see page 1010.)

France's Needs

Can Not Be Filled Now—Corporation Withdraws Prices

France, which has been the largest foreign customer of steel makers in the United States recently, especially for material for ammunition purposes, is having increasing difficulty to supply its needs and the Steel Corporation now has withdrawn all quotations to that country except on relatively minor products. Chairman E. H. Gary, of the Steel Corporation, in a formal statement, refers to this action as follows:

"The United States Steel Products Co. has recalled, temporarily, quotations in French markets, except as to pipe, tin plate and some specialties that involve a small tonnage, for the reason that steel products for delivery in the near future are sold well up to maximum capacity. Until the general questions of supply and demand are carefully considered, it is impossible to tell how much surplus we shall have for sale in France."

Greeted by Thousands

Ten thousand men, women and children living in Duquesne, Pa., last Saturday participated in a farewell celebration for Homer D. Williams, former superintendent of the Duquesne Steel works of the Carnegie Steel Co., who was appointed president of the company to succeed Alva C. Dinkey, the new head of the Midvale Steel & Ordnance Co., Philadelphia. Mr. Williams expects to move to Pittsburgh in the near future. He has taken an active interest in the welfare of the people of Duquesne since going to that city 12 years ago. Numerous gifts were presented Mr. Williams and his wife.

The New Milford Nut Co., New Milford, Conn., which is in bankruptcy, has been sold to H. R. McChesney, Danbury, for $15,625. He will operate the factory if he finds he can do so profitably, and if not, will move the business to Danbury.

Scrap Market

Shows Higher Prices in Most Centers—Some Irregularities

Philadelphia, Nov. 16.—In a spotty way the old material market shows some improvement. No. 1 railroad wrought is in good demand and has sold at $17, delivered, while $17.50, delivered, is reported. Recent railroad offerings brought over $17, delivered. Malleable has been sold at $13.50, delivered. The price range in cast scrap has been narrowed by an increased demand and the offering of higher prices by leading consumers. Heavy melting steel is being held back by consumers ordering shipments delayed because of congestion at receiving points. Under the buying of a large eastern Pennsylvania steelmaker who enters the market only on occasions, this grade went back to $15, delivered, the past week, but when the requests for the withholding of shipments came out the market receded to the old range of $14.50 to $15, delivered. Brokers are offering the inside figure.

Shipments Congested

New York, Nov. 16.—Congestion of shipments at several important consuming points in eastern Pennsylvania is tending to restrain the old material market in this territory. While no embargoes have been declared, both South Bethlehem and Coatesville are requesting the holding back of shipments. The undercurrent of the market appears stronger. For heavy melting steel, $15, delivered eastern Pennsylvania, now can be obtained. No. 1 railroad wrought is considerably higher. Some of the railroad lists just closed brought over $17, delivered. Transactions in steel negotiated by eastern dealers show a stronger condition of the Pittsburgh market.

Higher at Pittsburgh

Pittsburgh, Nov. 16.—With one of the more important buyers of heavy melting steel tentatively negotiating for future requirements, sellers of iron and steel scrap in the greater Pittsburgh district believe that this grade will advance to $16. Some middlemen now are refusing to shade that figure. Low phosphorus scrap is being held at $21, but that figure has not been tested. Shrapnel turnings are being offered by makers of shrapnel in this and adjacent territory in large quantities and prices continue weak and irregular.

Demand Increasing

Buffalo, Nov. 16.—The demand for all lines seems to be increasing. A number of sales have been closed by the yards here for considerable tonnages. Prices on heavy melting steel, low phosphorus steel scrap, No. 1 rerolled wrought, old steel and old iron axles and railroad malleable have been advanced in the past week.

Still Rising

Chicago, Nov. 16.—Higher quotations are registered in the iron and steel scrap market in Chicago on almost all lines. Heavy melting steel has continued its upward march and although consumers have not taken large tonnages in the past week, considerable material has changed hands and at constantly increasing prices. Shipments from this district to the east are less than formerly and dealers seem to be holding their accumulations tightly in anticipation of a buying movement which will return them a profit.

Railroad offerings at present are small, the Soo railroad offering 1,420 tons and the Monon 500 tons.

Higher at Cincinnati

Cincinnati, Nov. 15.—The scrap market is stronger, and advances of from 25 to 50 cents a ton have taken place on practically all old materials carried by local dealers. Shipments of steel scrap have been so heavy of late that stocks in dealers' yards are being reduced rapidly. Rolling mills are not buying at present, but they are expected to come into the market again before the end of December. Sales of cast scrap and stove plate are heavy, but the advance in prices mentioned above has been brought about principally through the strength and high quotations of pig iron and finished materials, more than because of transactions in the local market.

Active at St. Louis

St. Louis, Nov. 16.—The scrap market continues to be active here and prices are advancing all along the line. The large consumers have come into the market and now are buying freely at top prices. Competition for scrap offered by the railroads has been especially keen, and in a number of cases extravagant prices have been paid. The only railroad list out is one from the Chicago, Indianapolis & Louisville Railway for 560 tons.

Henry B. Darlington, 32 years old, secretary and treasurer of the Standard Steel Spring Co., Pittsburgh, committed suicide by firing a bullet into his brain at his home in that city, Nov. 14. Mr. Darlington had been in ill health for some time. He was born in Indianapolis and went to Pittsburgh 10 years ago where, for seven years, he was connected with the Union Spring Mfg. Co. He was instrumental in the organization of the Standard Steel Spring Co., with works at Coriopolis, Pa.

(*For complete prices see page* 1010.)

Spot Coke Declines

But Prices for Contract Fuel Have Not Been Changed

Pittsburgh, Nov. 16. — Spot furnace coke is being offered at $2.25, ovens, or 50 cents a ton below the price prevailing a fortnight ago. The Youngstown Sheet & Tube Co. has taken some coke for spot delivery at that figure. Demand is not heavy. The market for contract fuel shows no change in position. Seventy-two hour coke continues to command $3 a ton and above at the ovens. The labor situation in the coke regions shows no improvement, but is not yet acute. *The Connellsville Courier* for the week ending Nov. 6, says production was 424,162 tons, a decrease of 8,357 tons compared with the previous week.

Buys Furnace Coke

Philadelphia, Nov. 16.—Sales of about 50,000 tons of furnace coke both on contract and for shipment this year have been closed with eastern Pennsylvania consumers the past week. The prices have ranged from $2.50 to $3.00, Connellsville ovens, according to brand.

Furnace Coke Scarce

Cincinnati, Nov. 15.—Transactions in coke are low, because of the scarcity of furnace grades, and the fact that foundries are well covered on yearly contracts beginning last July. Dealers state that they could sell large tonnages of 48-hour coke if it could be secured, but ovens have practically their entire outputs contracted for until after the first of the year. Prices are very strong. No more furnace coke is available in either the Wise county or Pocahontas fields at $2.65, ovens, the price now being from $2.75 to $3, ovens. Furnace grades from these districts are being held at from $3 to $3.50, ovens.

Shipments Slow

St. Louis, Nov. 16.—Considerably more coke changed hands last week than has been reported for some time, mostly in car lots. Considerable trouble has been experienced in getting shipments forward, however.

Carnegie Anniversary.—Appropriate exercises will be held Nov. 23 and 24 by the Carnegie Institute of Technology, Pittsburgh, in celebration of the eightieth birthday of Andrew Carnegie and the fifteenth anniversary of the founding of the institute.

Few Structural Awards

Are Being Made, But Demand for Plain Material is Strong and Prices Are High

New York, Nov. 16.—Fabricating shop operations continue to reflect only a moderate demand for building steel. Eastern plants in general are running at from 60 to 70 per cent full. The eastern division of the American Bridge Co. is about 65 per cent active. The Brooklyn plant of this company has been shut down for lack of business and of the four other eastern shops, the Pencoyd works is the only one operating full. The others either are running short-handed or on short time. Mill congestion, caused by the demand in branches of steel other than structural, continues to cause plans for spring building to be pushed ahead. About 10 apartment houses now are in the market here for spring delivery and architects are working on a large assortment of plans. Plain material prices are very strong and eastern mills now are obtaining 1.70c, Pittsburgh, or 1.869c, New York, on current business. Standard shape deliveries are far deferred, but the Bethlehem Steel Co. is able to promise comparatively early shipments on its special sections.

October Lettings

October structural lettings amounted to 78 per cent of the total shop capacity of the country, or approximately 134,000 tons, according to the monthly statistics of the Bridge Builders' and Structural Society. In September they were 67 per cent, or about 115,000 tons.

The monthly reports of the Bridge Builders' and Structural Society showing the percentage of capacity booked and the approximate tonnage are as follows:

Month.	Per cent.	Approx. tonnage.
October, 1915	78	134,000
September	67	115,000
August	85	146,000
July	86	148,000
June	80	138,000
May	61	105,000
April	62½	107,500
March	64	110,000
February	30	51,000
January	25	43,000
December, 1914	35	60,000
November	20	35,000
October	35	60,000
September	38½	65,000
August	27½	48,000
July	68	115,000
June	56½	95,000
May	57	97,000
April	88	151,000
March	76	130,000

Steel Works Extensions

Philadelphia, Nov. 16.—Steel works extensions in eastern Pennsylvania are providing important structural requirements. Three contracts already closed call for about 6,000 tons and another for about 1,000 tons is pending. Pittsburgh district consumers are calling on eastern Pennsylvania shape mills for good tonnages, but, as a rule, cannot be accommodated as makers have not the product to offer. Eastern Pennsylvania makers now are quoting 1.70c, Pittsburgh, or 1.859c, Philadelphia, on the most attractive orders put up to them for shipment as the mill is able. For ordinary lots, 1.85c, mill, and for stocks, 2.00c, mill, is named. No quotations on first quarter contracts, as a rule, are being made. The American Car & Foundry Co. was a recent buyer of about 5,000 tons from eastern makers and still is negotiating.

Shapes Commanding Premiums

Pittsburgh, Nov. 16. — Structural shapes for forward shipment are being offered at 1.60c, but premiums ranging from $1 to $3 a ton are being obtained by some mills for nearby shipment. Specifications from car builders are more active and indications are that shipments to car manufacturers will increase considerably the next few months. Fabricators, all of whom are busy, cannot promise material in less than three or four months.

Question of Shipment

Buffalo, Nov. 16. — No contracts or sales are being solicited by the mills and agencies of the Buffalo district. The concern of the producers with respects to shapes, plates, bars and the general lines is to make shipments on material under contract. Deliveries are becoming more extended. Inquiries for additional tonnages are being considered directly by the mills and only the most urgent needs of established customers are receiving even this consideration. Prices are being quoted nominally at 1.60c, base, but further advances are expected.

Many of the smaller buyers are placing round tonnages with the jobbers because of their inability to receive consideration at the mills. Jobbers in turn are beginning to limit sales in order to protect their available stocks.

Structural Business Light

Chicago, Nov. 16.—Tonnages of structural shapes now being placed are extremely small and constructors apparently feel the time is not right for buying except in cases of extreme necessity. Mills are well filled and have little tonnage to offer and for the most part fabricating shops are well employed. A nominal quotation of 1.79c, Chicago, is the ruling price.

(*For complete prices see page* 1010.)

Great Construction Activity

A remarkable increase of activity of building construction has been noted through several months, and October seems to top the list. According to figures gathered from 102 cities by *Construction News*, permits were taken out during October for 23,300 buildings at an estimated cost of $64,494,792, compared with 20,191 buildings at an estimated cost of $48,489,481 during October, 1914. This is an increase of approximately 33 per cent over the preceding year. Seventy-one cities show increases and 31 cities show decreases.

The most significant feature of this showing seems to be the renewed activity in Chicago, where permits were taken out for 1,111 buildings involving an estimated cost of $12,479,250, compared with 824 permits at an estimated cost of $6,774,200 during October, 1914, giving a gain of 84 per cent, whereas New York, including Manhattan and the Bronx, made a gain of only 1 per cent. Further analysis of the figures on Chicago's activity show that more permits were taken out in Chicago during October than in New York and Boston, while the estimated cost is only a trifle less than the total investment in building construction in New York, Boston and Brooklyn.

CONTRACTS AWARDED.

Sanitary District of Chicago, steel and controlling works for Calumet Sag Channel, 702 tons, to American Bridge Co.

Thorpe Brothers, Minneapolis, Minn., warehouse, Minneapolis, Minn., 296 tons, to Minneapolis Steel & Machinery Co.

Masonic Temple, Terre Haute, Ind., 190 tons.

Ogden, Logan & Idaho railroad, shops and car barns, Ogden, Utah, 184 tons, to American Bridge Co.

Extension to open hearth works of Worth Bros. Co., Coatesville, Pa., 1,000 tons, to an independent shop.

Extension of open hearth department of the Alan Wood Iron & Steel Co., Ivy Rock, Pa., 2,500 tons, to the McClintic-Marshall Co.

Enlargement of plant of Standard Steel Works Co., Burnham, Pa., 2,500 tons, to the McClintic-Marshall Co.

Consolidated Gas Co. building, Baltimore, 3,000 tons, to the American Bridge Co.

Lumber sheds for Lehigh & Wilkesbarre Coal Co., 200 tons, to the Fort Pitt Bridge Works.

Apartment for the West End Apartment House Co., Eighty-ninth street and West End avenue, New York City, 700 tons, to the Hinkel Iron Works.

Appraisal stores, Boston, for the United States government, 2,000 tons, to Milliken Bros.

Loft building for the Haseo Building Co., Twenty-eighth street and Fourth avenue, New

York City, 1,100 tons, to the Harris-Silvers-Baker Co.

No. 2 Audubon telephone central station, New York City, 300 tons, to Eidlitz & Ross.

Buildings for the Eastman Kodak Co., Rochester, N. Y., 300 tons, to the American Bridge Co.

Bridge work for the Lehigh Valley railroad, 800 tons, reported to have gone to the Pennsylvania Steel Co.

Duquesne freight station, Pittsburgh, 800 tons, awarded the Jones & Laughlin Steel Co.

Bridge material for the Cincinnati, Indianapolis & Western railroad, 1,500 tons, awarded the American Bridge Co.

Schoellkopf Analine & Chemical Works, Buffalo, plant addition, contract for structural steel, 150 tons to Ferguson Steel & Iron Co., Buffalo, John W. Cowper Co., Buffalo, general contract.

STEEL CONTRACTS PENDING.

Electricification work for the Chestnut hill division of the Pennsylvania railroad, 500 to 600 tons, bids being taken.

Additional bridge work for the Southern railroad, 500 tons, bids being taken.

Bridge work for the Baltimore & Ohio railroad, 1,200 tons, bids taken.

Extensions to the open hearth plant of the Worth Bros. Co., Coatesville, Pa., 1,000 tons, bids being taken.

Raritan building, Perth Amboy, N. J., 200 tons, bids being taken.

Section No. 2 of the Seventh-Lexington avenues line, New York City, 29,000 tons, bids to be taken Nov. 30.

Extension of No. 4 machine shop of Midvale Steel Co., Philadelphia, 500 tons, bids being taken.

Superstructure for McKeon street pier, Philadelphia, about 4,000 tons, bids being taken.

Another section of elevated railroad extensions for city of Philadelphia, about 5,000 tons, plans issued and bids asked.

Bridge work for Baltimore & Ohio railroad, about 1,100 tons, bids taken.

Municipal General Hospital, Buffalo, five buildings, George Baker Long, Boston, low bidder general contract, requiring 700 tons.

Morrow Mfg. Co., Elmira, plant additions, Compton Realty Co., general contractors, taking sub-bids on structural, 200 tons.

Spelter Advance

Follows Heavy Buying—Other Metals in Active Demand

New York, Nov. 16.—The week closing today has been characterized by considerable excitement and a strong upward price tendency in most of the metals. Fairly heavy buying of copper and spelter on both domestic and foreign account materialized in sharp advances every day. None of the first hands now will book electrolytic copper at less than 19c, delivered 30 days. A number of sellers will not quote because of their sold-up condition, which, in many cases, extends three or four months into the future. Most lake copper producers have withdrawn temporarily from the market because of their heavy bookings the last few days. The best brands of casting copper are scarce because of the strike in the Clifton-Morenci district of Arizona. Ordinary casting copper is quoted at 18.62½c to 18.87½c, cash.

Demand for spelter continues brisk both from the galvanizers and the brass mills. The metal is not offered freely; in fact, some producers are not quoting, due to their sold-up condition. Spot prime western is quoted at 17.37½c to 17.50c, St. Louis, although some interests are asking as high as 18c. November is quoted at 17.25c to 17.50c, December at 17c to 17.25c, January at 16.75c to 17c and the first quarter of next year at approximately 16c. Spot brass special is nominally quoted at 18.50c to 19c, St. Louis.

Car Orders

Are Being Freely Placed—Bids in on Pennsylvania Inquiry

New York, Nov. 17. (By wire.)—Orders for 5,000 to 6,000 additional cars have been placed. The Lackawanna gives 1,000 box, 500 gondolas, and 500 hoppers to the American Car & Foundry Co. The Western Pacific has awarded 1,000 box cars to the Pullman. The Central of New Jersey awarded 1,250 box cars, of which 750 went to the American Car & Foundry, and 500 to the Standard Steel Car Co. The New York Central has ordered 1,000 additional box cars, divided between the American Car & Foundry Co. and Haskell & Barton. The Reading has ordered 500 additional coal cars from the Standard Steel Car Co. The Ralston Steel Car Co. takes 500 car bodies from the Baltimore & Ohio.

A new inquiry from the Katy system is for 500 general service cars. Bids are in today on the Pennsylvania inquiry for 11,000 cars.

Locomotive Orders

New York, Nov. 16.—The Boston & Albany railroad has placed four Mallett locomotives with the American Locomotive Co. The Birmingham Southern railroad has placed one consolidation and two six-wheel switching locomotives with the American Locomotive Co. The Missouri, Kansas & Texas railway has placed five Pacific type locomotives with the American Locomotive Co. The New York, New Haven & Hartford railroad has placed 33 Mikado type locomotives with the American Locomotive Co.

Spikes Strong

Pittsburgh, Nov. 16.—Standard railway spikes are being held at 1.85c and above in the greater Pittsburgh district. A number of attractive orders have been placed this month and some mills say they are not anxious to sell additional tonnage at the prevailing market price. That spikes will command 2c before the end of the year, is the prediction made by manufacturers.

Pending Locomotives

Cleveland, Nov. 16.—The Lima Locomotive Works is figuring on 26 locomotives for the Elgin, Joliet & Eastern, a Steel Corporation road, and expects to receive an order for 52 locomotives from the Pennsylvania railroad.

Rock Island Buys Rails

Chicago, Nov. 16.—Illinois Steel Co. has been awarded 40,000 tons of steel rails by Receiver Dickinson, of the Rock Island railroad, under permission of the federal court granted several days ago. The contract calls for delivery of these rails between April and December, 1916.

The New York Central lines have placed 4,000 tons of rails additional with the Illinois Steel Co. The inquiries for 4,300 tons for the New York, Ontario & Western and for 10,000 tons for the Maine Central still are pending.

Rush Order

Jeffersonville, Ind., Nov. 16. — The plant of the American Car & Foundry Co. here is now employing 2,000 men, business showing signs of improvement weekly. A rush order has just been received from the Norfolk & Western for 12 mail and baggage cars. The cars are wanted for the Christmas traffic season and the plant is working seven days a week in two shifts.

Low Prices for Delayed Deliveries

Pittsburgh, Nov. 17. (By wire.)—Pittsburgh manufacturers of plates, shapes and bars continue to quote these products nominally at 1.60c, but it is not unlikely that prices will be advanced to a 1.70c basis this week. The Carnegie Steel Co. and the Jones & Laughlin Steel Co. have not withdrawn the 1.60c price, but are not in a position to offer anything like prompt delivery.

Date for Argument

The interstate commerce commission has set Dec. 3 as the date for argument on the application to establish a rate of 55 cents per 100 pounds on iron and steel material from Pittsburgh to Pacific coast terminals.

C. K. Turner & Son, manufacturers' export agents, 116 Broad street, New York, are in the market for 46 tons of steel bars including diameters of ¼, ⅜, ⅜ and ½-inch and ranging from 12 feet up to 32 feet 5 inch diameter.

(For complete prices see page 1010.)

Will Build Largest Plate Mill

Lukens Iron & Steel Co.'s Addition—Corporation Will Build at Gary, Pittsburgh and Youngstown—Other New Plants

ENLARGEMENTS of eastern steel works made necessary to accommodate the enormous demand which is breaking all records for these producers, are becoming numerous.

The Lukens Iron & Steel Co., Coatesville, Pa., has placed orders for a new plate mill which is to be the largest in the world. The exact length has not yet been determined, but it will be either 200 or 204 inches. This compares with a 178-inch mill located at Witkowitz, in Austria-Hungary, a 178-inch mill just ordered for the Imperial Steel Works of Japan and a 168-inch, 2-high, reversing mill at the Dalzell works near Glasgow, Scotland. The Lukens Iron & Steel Co.'s mill will be 4-high and provided with chilled working rolls, 34 inches in diameter, supported both at the top and bottom by steel rolls 50 inches in diameter. The tables will be stationary, as all the rolling will be in the center line between the two chilled rolls. This mill is to be driven by a 55 x 60-inch compound condensing reversing engine unless experiments now being made indicate that this engine will be too large; in the latter eventuality, a smaller engine will be used. By installing this mill, to satisfy the demand for wider and wider plates, not only for marine boilers but for locomotive boilers, the Lukens company is following out the policy it established many years ago. In 1890, that company put in a 120-inch mill, which then was the widest in this country. In 1902, it put in its 140-inch mill, which again was the widest in this country at the time. The building of the new mill will necessitate also the building of a number of open hearth steel furnaces as well as other equipment.

The Standard Steel Works Co., Burnham, Pa., is increasing its capacity by the installation of two 75-ton basic open hearth furnaces, a wheel-rolling mill, additional gas producers, etc. The Alan Wood Iron & Steel Co. is adding three 50-ton basic open hearth furnaces and other improvements at Ivy Rock, Pa. The Worth Bros Co. has let contracts for the erection of an extension of its open hearth department at Coatesville which will embrace several more furnaces. The Midvale Steel & Ordnance Co., which now owns the Worth plant, also has plans out for an important addition to the No. 4 ordnance machine shop of the Midvale Steel Co. plant at Philadelphia.

Additions

To be Built by Steel Corporation at Gary, Pittsburgh and Youngstown

Elbert H. Gary, chairman of the United States Steel Corporation, made the following statement last Thursday:

"We have decided to make additional improvements at Gary, Ind., consisting of two blast furnaces, several open hearth furnaces, blooming mill, duplexing plant, etc., costing over seven and a half millions, the exact figures of which are not yet ascertained, and will probably commence work in the immediate future.

"We have also decided to make additional improvements at Youngstown, O., and Pittsburgh, which will cost between $1,000,000 and $2,000,000."

Three More Furnaces

The Carnegie Steel Co. announces the Steel Corporation has made an appropriation for three additional open hearth furnaces at the Ohio works, Youngstown, to cost approximately $800,000. This will give the plant 15 open hearth furnaces, it operating 12 at present.

Sites Are Selected

Chicago, Nov. 16.—The new Gary duplexing plant will be built on the space reserved for No. 2 open hearth plant on the original plans, this unit having been left out when the present plant was constructed. The additions are practically all in line with the original plan formed before the present plant was built, the only exception being substitution of the duplexing plant for the No. 2 open hearth unit. Construction operations will be started as soon as plans are completed and contracts can be let, and the additional capacity will be put into service at the earliest possible moment to relieve in some degree the tremendous demand for steel.

The new work projected by the Steel Corporation for plants near Chicago will cost approximately $13,000,000. The appropriation for additions at the Gary plant of the Illinois Steel Co. are estimated to cost $7,500,000; the duplexing plant at South Works of the steel company will cost about $2,250,000, and the tin plate plant of the American Sheet & Tin Plate Co. at Gary will cost $3,000,000.

Three Additions

The Hydraulic Pressed Steel Co., Cleveland, has taken out permits for three additions, costing about $50,000, at its plant at 3152 East Sixty-first street, in that city. Two of the additions will be inclosed in glass. One will be 70 x 360 feet and the other 80 x 200 feet, costing $21,000 and $17,000, respectively. The third structure will be 60 x 120 feet, of steel and brick construction. All are to be one story high. It is understood the Hydraulic company is said to be the only Cleveland concern now manufacturing shells for the United States government. J. H. Foster, vice president and general manager, is quoted as saying that the ammunition contract is small and that the new additions are not being erected to handle it.

Will Soon Be Making Billets

Chicago, Nov. 16.—The blast furnace plant of the Minnesota Steel Co. at Duluth probably will be making iron by November 20. The coke plant has been producing fuel for some time, but delay was experienced in arrival of stock conveyor cars for the blast furnace, which has prevented production of pig iron.

Arrangements are complete for beginning the production of steel five days after the first pig iron is produced and three open hearth furnaces of the seven are now ready to receive iron and convert it into steel. The billets will be shipped to Chicago and there rolled into finished products.

Magnesite Plant

The American Refractories Co., of Chicago, has leased the plant of the Buckeye Portland Cement Co. at Harper, O., which is now being equipped and machinery installed for the calcination and production of dead burned magnesite on a large scale.

Large tonnages of California mag-

nesite have been purchased and it is expected the plant will be in operation the last of this month or early in December. It will be run continuously until conditions in Europe permit a resumption of shipments from the large magnesite works of the Austro-American Magnesite Co. at Radenthein, Austria, which has now a capacity of 150,000 tons of calcined magnesite per year.

Many Buildings

Are Being Erected in Detroit—Ford's Plans Discussed

Building operations are being rushed in Detroit. During the past month, there has been an increase of nearly 75 per cent over the same month last year and in the downtown section a number of big business blocks are nearing completion. During the past three or four years, the business section of the city has been magnified by the addition of more than a dozen buildings ranging from 12 to 24 stories. Predictions are being made that the growth during the coming three years will be heavy, though not quite as rapid as formerly.

Detroit now has, according to various agencies, a population of better than 730,000. This, of course, includes the very immediate suburbs and the population of the city proper is placed around the 670,000 mark, or an increase of more than 200,000 in five years. There has been a tendency to grow towards the north and northwest and real estate operators say that a new business section will be built up on Grand River avenue, about six or seven miles from the city hall. This, they say, will be a business section very similar to the Grand avenue section in St. Louis. Property values in the district have more than doubled in a year and Grand River frontage which was selling for $50 a year ago is now bringing from $100 to $150 a foot.

There is also a growing suspicion that Henry Ford will change his plans relative to building a tractor plant in the vicinity immediately west of the city limits. It is understood that a number of real estate operators have secured options on land which Mr. Ford desires and they are now trying to boost the price over the quotations on adjoining land. A Detroit banking man who has personal interests with Mr. Ford says he would not be surprised if the tractor plant were to be built further west than now planned, so as to escape this "high price policy."

Michigan Engineering Co., Saginaw, Mich., has increased its capital stock from $50,000 to $75,000.

Open Hearth Plant

Will be Built in Nova Scotia—Shipbuilding at a Standstill

Toronto, Nov. 16.—The Nova Scotia Steel & Coal Co. of New Glasgow, N. S., will at once proceed with the construction of an open hearth furnace of the largest type, which it is expected will be completed in three months. President Canbley, reported that a new equipment for forging 8, 9 and 12-inch shells has been contracted for and will be delivered within 40 days.

The first steel ever made in northern Ontario was produced on Nov. 6 at the Wabi Iron Works of New Liskeard. It was made by the electric process in a furnace of the Heroult type with a capacity of five tons per day. The manganese steel used in Canada has hitherto been imported from the United States or England.

The shipbuilding trade is practically at a standstill owing to the steady advance in the price of American steel and the inability of manufacturers to guarantee deliveries under four months. A large number of men would be thrown out of work for the winter, but for the fact that many shipbuilding firms have obtained shell contracts.

Preparing to Rebuild

The Bethlehem Steel Co., South Bethlehem, Pa., has started clearing away the ruins of No. 4 machine shop, badly damaged by fire last week, and reconstruction will begin at once. Every one of the 2,100 men who was left jobless as the result of the fire was given employment in other departments of the plant.

Will Lay Corner Stone

The corner stone of the National McKinley Memorial building, at Niles, O., will be laid Saturday, Nov. 20, with appropriate dedication exercises. The corner stone will be laid at 1 o'clock, and preceding this ceremony there will be a parade of Spanish and Civil War veterans. The United States marine band will take part in the program.

Requests Catalogs. — The Inland Steel Casting Co., Terre Haute, Ind., is now in business independently, manufacturing both annealed steel and malleable castings. The company requests catalogs of such supplies as it uses.

The Coleman Foundry Equipment Co., Cleveland, industrial plant and foundry engineer, will design and superintend the construction of a machine shop for the American Car & Ship Hardware Mfg. Co., New Castle, Pa. The building will be 60 x 140 feet and the office on the second floor of this structure will be 30 x 60 feet.

Holding Company

For Concerns Which Will Manufacture Munitions

The Phillips Corporation, capitalized at $30,000,000, has been organized under the laws of Delaware as a holding company for the vast interests acquired by Ralph B. Phillips, Boston, in the past few months to manufacture war munitions. It has issued $25,000,000 worth of stock, divided into $12,500,000 7 per cent cumulative preferred and a like amount in common. Mr. Phillips will be president of the corporation; Lloyd H. Atkinson, formerly of the Bethlehem Steel Corporation, vice president, and James Verner Critchley, Worcester, Mass., one of the directors. The five operating companies making up the merger will continue to be conducted separately with but few, if any, changes in their individual officials. These, with their capitalization, are: The American Steam Gage & Valve Mfg. Co., Boston, $400,000; R. B. Phillips Mfg. Co., Boston, operating plants in Worcester and Lowell, Mass., $400,000; Windsor Machine Co., Windsor, Vt., $325,000; National-Acme Mfg. Co., Cleveland and Montreal, $2,500,000; and the White Mountain Paper Co., Portsmouth, N. H., which will be renamed the New England Steel & Ordnance Co. The last two companies to be secured by Mr. Phillips were the Windsor Machine Co. and the National-Acme Mfg. Co. One of the most important plants is to be the New England Steel & Ordnance Co., formerly known as the Colonial Paper Co., at Freeman's Point, Portsmouth, N. H., which originally cost $2,000,000.

When the new machinery is installed there, it is planned to develop the property into a large ship building and ordnance plant and it is stated the company already has contracts through Mr. Phillips for supplying war munitions for the allies to the extent of $50,000,000. These orders include French shell casings, Russian shells, English shell fuses, machinery and copper shell bands.

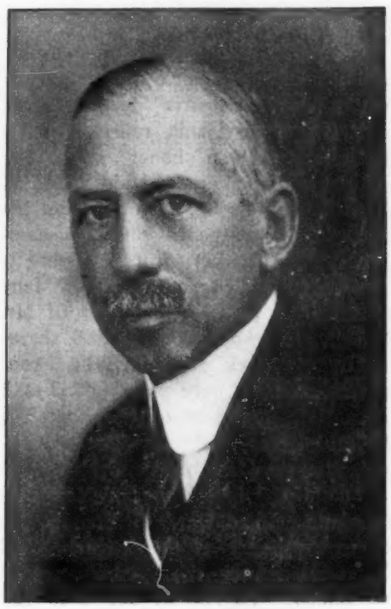
The Youngstown Sheet & Tube Co., Youngstown, O., has placed an order with the Pittsburgh Bridge & Iron Works for approximately 300 tons of structural steel for its machine, boiler and other shops at the coke plant.

MEN OF THE IRON TRADE

Who they are **Where they are** **What they are doing**

F. H. Tackaberry recently resigned as assistant general manager of sales of the Pennsylvania Steel Co. to devote his energies exclusively to personal interests. Associated with Martin McVoy Jr., at 1 Liberty street, New York, he will be an active officer and director in the Industrial Underwriters, Inc.; the V. & O. Press Co., Glendale, L. I., and the Locke Steel Belt Co., Bridgeport, Conn.

Mr. Tackaberry was a member of the sales department of the Penn-



F. H. TACKABERRY

sylvania Steel Co. for more than nine years. In June, 1906, he was appointed sales agent for Mexico and continued in that position until conditions made it expedient to discontinue active business relations with that country. On his return to the United States, he was appointed assistant general manager of sales.

Major H. Kenodo, directors of the Atsuta arms factory, Japan, is in Canada studying the development of the shell industry.

Lloyd Atkinson, formerly rail salesman of the Bethlehem Steel Co., now is connected with the newly formed New England Steel & Ordnance Co. in the capacity of vice president.

R. J. Johnston, former assistant to the superintendent of the Donora, Pa., plant of the American Steel & Wire Co., has been appointed superintendent of the zinc works of the company at Donora.

Col. Frederic Nicholls, of Toronto, president of the Canadian General Electric Co. and acting president of the Dominion Steel Corporation, is in England in connection with orders for war munitions.

Frank Van Anden has been appointed district sales manager in charge of the New York office of the Van Dorn & Dutton Co., Cleveland, specialist in gears and gear cutting. The company has moved its New York office from 50 Church street to 556 West Thirty-fourth street.

Lawrence H. Cooney, superintendent of the finishing mills of the Ohio Works of the Carnegie Steel Co., at Youngstown, has resigned to become general manager of the mills of the Algoma Steel Co., Sault Ste. Marie. At one time Mr. Cooney was at the Edgar Thomson works of the Carnegie company at Braddock, Pa.

C. B. Auel, director of standards, processes and materials of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., talked about Efficiency and Common Sense, Nov. 15 at the regular monthly meeting of the Pittsburgh Foundrymen's Association. The meeting followed a dinner at the Fort Pitt hotel.

C. H. Williams, former assistant superintendent of the Schoenberger Steel Works of the American Steel & Wire Co. at Pittsburgh, has been appointed assistant to the superintendent of the plant at Donora, Pa. He has been succeeded by William Pickford, formerly superintendent of the bessemer department of the Schoenberger works.

W. LaCoste Neilson, foreign manager of the Norton Co., Worcester, Mass., and Frank Roe Batchelder, treasurer of the Mills Woven Cartridge Belt Co., Worcester, Mass., sailed for London recently from New York on the Holland-American steamship NIEUW AMSTERDAM. Mr. Neilson returns to his headquarters there after a month's visit in the United States, while Mr. Batchelder will make his headquarters at the London branch of the company until about Christmas. Both plants of the company are rushed with war orders.

A paper which commanded notable attention and comment at the recent meeting of the American Iron and Steel Institute at Cleveland, and which was published in the Oct. 28 issue of *The Iron Trade Review*, was that on "The Mechanical Development of Sintering", written by Bethune G. Klugh, field manager of the American Ore Reclamation Co., New York. Mr. Klugh, who is stationed at Pittsburgh, is considered a leading authority on modern nodulizing processes.

Owing to the misleading notices which have been published by some

B. G. KLUGH

newspapers relative to changes in the organization of the J. I. Case Threshing Machine Co., Racine, Wis., the company states that its present officers are as follows: Frank K. Bull, president; E. J. Gittins, vice president, in charge of sales; M. H. Pettit, vice president, in charge of plants and production; Warren J. Davis, treasurer; William F. Sawyer, secretary; C. J. Farney, assistant treasurer; R. P. Howell, assistant treasurer; Stephen Bull, assistant secretary. Mr. Gittins and Mr. Pettit, the new vice presidents, have been identified with the company for a number of years.

The Harbison-Walker Refractories Co., Pittsburgh, has declared a dividend of 1 per cent on the common.

Banks Back of Replogle

In the Cambria Deal, Says Babcock, Who is Associated With Other Pittsburgers

J. Leonard Replogle, vice president and general sales manager of the American Vanadium Co. and formerly vice president and general sales manager of the Cambria Steel Co., has purchased the remaining holdings in the Cambria Steel Co. of the Pennsylvania railroad, representing approximately 250,000 shares. The company's present outstanding capitalization is 900,000 shares. The Pennsylvania railroad recently sold a portion of its Cambria Steel stock and its holdings in the Pennsylvania Steel Co. to W. H. Donner, president of the Cambria Steel Co. and chairman of the Pennsylvania Steel Co., and his associates. This action, it was thought, generally, was a long step in the direction of the eventual consolidation of the Pennsylvania and Cambria Steel companies which had been talked about for several years.

Mr. Replogle has made no statement as to what plans are being furthered by his purchase of so large a block of stock as that which now has passed to his control. Various reports have been in circulation that eventually it may mean his return to the company in some executive capacity, but there is no authoritative support for any such expectation at present. Mr. Donner's present annual term as president extends to March 15, 1916.

Mr. Replogle is regarded as one of the leaders among the younger generation of steel men in this country. Until he resigned as vice president and general sales manager of the Cambria Steel Co. on March 1, 1915, to take similar posts with the American Vanadium Co., all his business career had been spent with the Cambria Steel Co. This extended over a period of 27 years, beginning as an office boy at the age of 13, and it embraced many of the most responsible positions in the organization. Mr. Replogle at present is 39 years of age.

That several prominent Pittsburgh manufacturers and commercial men are associated with a syndicate headed by Mr. Replogle, has been confirmed by E. V. Babcock, a former member of the Pittsburgh council and a prominent lumber merchant. The names of Frank J. Lanahan, president of the Fort Pitt Malleable Iron Co., and Charles J. Graham, vice president of the Graham Nut Co., are closely connected with that of Mr. Babcock. Mr. Babcock states that the Mellon National Bank of Pittsburgh and Drexel & Co., Philadelphia, are back of the purchase of the Pennsylvania railroad's holdings.

Mr. Babcock, who was born near Fulton, N. Y., in 1864, is president of the Babcock Lumber Co. of Pennsylvania, the Babcock Coal & Coke Co. of West Virginia, and is vice president and a director of the Columbia National Bank of Pittsburgh, and a director of the Colonial Trust Co. of the same city. He was appointed a member of council by Gov. John K. Tener in 1911, and subsequently was elected to the same office for one term.

Mr. Lanahan is president and manager of the Fort Pitt Malleable Iron Co., with works at McKees Rocks, Pa. He is a director of the Chartiers Trust Co. of McKees Rocks and vice president of the Davis Brake Beam Co., Johnstown, Pa. He also is a director of the chamber of commerce of Pittsburgh, the Pittsburgh Railway Equipment Co., the Regal Paint & Oil Co. and the Railway Supply Manufacturers' Association.

Mr. Graham, who recently was elected president of the American Hardware Manufacturers' Association, is vice president of the Graham Nut Co., Pittsburgh, with which he became identified in 1896. He is a director of the company and also of the Davis Brake Beam Co., Johnstown.

Outlook for Pennsylvania Steel

Mr. Donner took occasion yesterday to confirm in part the report that a new company, the Keystone Steel Co., was being considered in plans to take over the Pennsylvania Steel Co. to operate it on an extensive basis, says the *Public Ledger*, of Philadelphia. If this is done the Keystone Steel will become a holding company for the Pennsylvania Steel alone. It will not, he said, take over the Cambria. Under present plans the Cambria will not be combined with any other corporation, but will operate as an independent concern.

"The Keystone Steel Co.," he said, "is merely a financial arrangement for putting the Pennsylvania Steel on its feet. This company, as everybody knows, needs but one thing—money. Keep your eyes on Pennsylvania Steel. It has splendid opportunities, and I am very enthusiastic over it. But our plans are not yet completed, and the suggestion of the Keystone is just one method to which we are giving consideration."

Mr. Donner admitted the Pennsylvania railroad and the Reading company had been approached with a proposition to take over the rest of their holdings of Pennsylvania Steel stock, which combined represent about 38 per cent of the entire outstanding issue. And he confirmed in substance that the terms considered at present consisted in exchanging the preferred stock of the Pennsylvania Steel at par and the common at 45 for Keystone Steel 20-year 5 per cent bonds, the stock to be deposited as collateral for the bonds.

"Whatever arrangements we come to with the railroads," he emphasized, "the public will be allowed to participate on an equal basis."

Dinner to Replogle

Pittsburgh, Nov. 17. (By wire.)—J. Leonard Replogle, who recently bought heavily Cambria Steel Co. stock from the Pennsylvania railroad for a syndicate, was an honor guest last night at a dinner at the home of E. D. Babcock, who also is identified with the syndicate. Twenty-eight business associates of Mr. Babcock attended what is described as a social affair. Many tributes were paid to the ability of Mr. Replogle, in whose name 240,000 shares of Cambria stock owned by the Pennsylvania railroad were purchased. Frank J. Lanahan, president of the Fort Pitt Malleable Iron Co., Charles J. Graham, vice president of the Graham Nut Co., both of whom are connected with the syndicate, and Harry S. Endsley, for 30 years solicitor of the Cambria Steel Co., were among those who attended the dinner. Except to say that Mr. Replogle's presence in Pittsburgh yesterday was of no particular significance, no definite announcement has been made about the dinner.

Case Reopened

Washington, Nov. 16.—An order was entered yesterday by the interstate commerce commission in the Vulcan Iron Works Co. case, reopening it for such further hearings as the commission may direct. At the same time the commission denied motions to vacate the order of Sept. 20, suspending the rate of 60c per 100 pounds on iron and steel articles from Mississippi river crossings to Denver. Under the suspension order, the 45c rate was continued in operation, pending further action, and it was the desire of the complainants to vacate this order, leaving the latter rate in effect permanently.

Heat Treatment of Modern Steels

IN ITS broadest sense, heat treatment, declares this author, may be described as the transformation of an alloy from a mechanical mixture of two substances into a homogeneous solution of a single substance. He points out that in its simplest form, without other modifiers, steel is an alloy of iron carbide and iron. The value of proper heat-treatment in giving steel power to resist repeated shock, is emphasized.

By Robert R. Abbott

STEEL is an alloy. In its most simple form it is made up of two components: iron and a carbide of iron technically known as cementite and having the chemical symbol Fe_3C.

Commercial steel always has at least four other elements present: phosphorus, sulphur, manganese and silicon. Phosphorus and sulphur are usually objectionable impurities, while manganese and silicon are required in the finished steel to insure good material. The total amount of these four elements contained in an ordinary commercial steel is less than 1 per cent. The influence of the average variation in all of these impurities upon the physical properties of the steel is slight, compared with the effect of the carbon. We can, therefore, eliminate them in our consideration of the structure of commercial steel.

The carbon is the main factor in influencing variations in the physical properties. It varies from practically nothing in wrought iron to about 1.5 per cent in high carbon tool steel. A variation of 0.001 per cent of carbon will affect the tensile strength of annealed steel about 8,000 pounds per square inch. This seems rather remarkable, but it is more readily understood when the following facts are considered; the carbon exists as cementite, which is 15 times as heavy as the carbon of which it is composed. In steel, this cementite occurs intimately mixed with about 6½ times its own weight of iron. One part of carbon, therefore, makes up about 112½ parts of this mixture, which is known as pearlite. Its structure is shown in Fig. 1. The black material is the iron, while the white is the cementite. A steel containing 0.1 per cent carbon is then really composed of about 11 per cent pearlite and 89 per cent iron.

FIG. 1—PEARLITE
Magnification 1,200 diameters

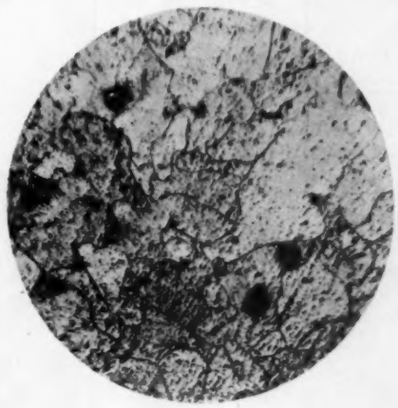


FIG. 2—IRON
Magnification 150 diameters

Fig. 2 shows a sample of iron which contains about 0.01 per cent carbon, making the structure 1 per cent pearlite and 99 per cent iron. This pearlite is not visible under this magnification, and, therefore, the material has the appearance of pure iron. The network of lines represents the boundary of individual crystals of iron. As the carbon increases the pearlite areas become larger and the amount of iron smaller.

Fig. 3 shows a steel containing 0.20 per cent carbon and, therefore, about 22 per cent pearlite. Fig. 4 shows a still further increase in carbon to 0.40 per cent, which is equivalent to 45 per cent pearlite and 55 per cent iron. Fig. 5 shows an 0.80 per cent carbon steel, which contains 90 per cent pearlite and 10 per cent iron, while in Fig 6 there is no excess iron and, therefore, 100 per cent pearlite, which is equivalent to a 0.90 per cent carbon steel.

As the carbon increases about the point necessary to form 100 per cent pearlite it must necessarily exist as free cementite, as all the iron has been taken up to form pearlite when the carbon reached 0.90 per cent. Fig. 7 shows a steel with 1.4 per cent carbon. It consists of 92.5 per cent pearlite and 7.5 per cent cementite. Fig. 8 is a steel containing 2.5 per cent carbon. It consists of 24 per cent cementite and 76 per cent pearlite. A steel of this high carbon is rare and has no commercial application. White cast iron, which is the material from which malleable iron is made, is an impure steel of a carbon content similar to this.

Briefly summarizing the structural condition of a series of steel of various carbon contents, we see that one containing 0.9 per cent carbon consists of 100 per cent pearlite. This steel is known as saturated, or commonly, an eutectoid steel. A steel containing less than 0,9 per cent carbon contains pearlite and iron. Such a steel is known as an undersaturated or hypo-eutectoid steel. A steel with more than 0.9 per cent carbon is known as a supersaturated or hyper-eutectoid steel. Fig. 9 shows the same piece of steel containing supersaturated, saturated, and undersaturated bands. The carbon content varies from 2.5 per cent to 0.2 per cent.

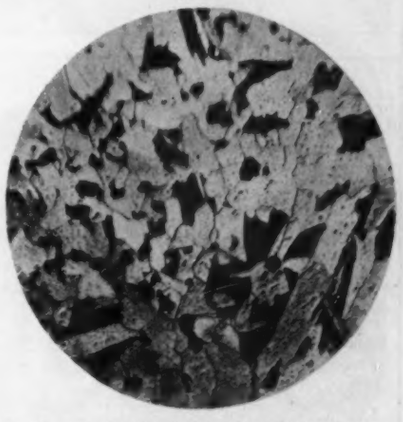


FIG. 3—IRON AND PEARLITE 0.20 PER CENT CARBON
Magnification 150 diameters

When a piece of steel is pulled apart in a tensile machine the cross-sectional area at the point of fracture is less than that of the original bar. The amount of this difference is known as the "reduction in area," and it is a fair measure of the toughness of the steel. While the meaning of the term "tough-

Presented at a joint meeting of the mining and metallurgical section of the Franklin Institute and the American Society of Mechanical Engineers. The author, Robert R. Abbott is metallurgical engineer, Peerless Motor Car Co., Cleveland.

FIG. 4—IRON AND PEARLITE 0.40 PER CENT CARBON
Magnification 150 diameters

FIG. 5—IRON AND PEARLITE 0.80 PER CENT CARBON
Magnification 150 diameters

FIG. 6—PEARLITE 0.90 PER CENT CARBON
Magnification 150 diameters

ness" is open to more or less dispute, we can consider it as the ability of the metal to distort without causing fracture. For example, a steel which can be bent through an angle of 75 degrees before fracture is tougher than one which can be bent only 25 degrees.

If tensile tests are made on a series of steels of increasing carbon contents, we find that the tensile strength increases with the increase in the amount of pearlite, but the toughness decreases. The tensile strength of iron is about 40,000 pounds per square inch. This can be increased by about 700 pounds for each increase of 1 per cent pearlite. The reduction in area for pure iron is about 80 per cent, and this is decreased by about 0.5 per cent of each increase of 1 per cent pearlite. For ordinary structural purposes, a steel which is subject to vibration or shock is not safe with much less than 50 per cent reduction in area. From these figures it is readily calculated that a steel with 60 per cent pearl-

FIG. 7—CEMENTITE AND PEARLITE 1.4 PER CENT CARBON
Magnification 150 diameters

FIG. 8—CEMENTITE AND PEARLITE 2.5 PER CENT CARBON
Magnification 150 diameters

FIG. 9—UNDER-SATURATED, SATURATED AND SUPER-SATURATED BANDS
Magnification 150 diameters

ite, which corresponds to about 0.55 per cent carbon, has a reduction in area of about 50 per cent. Such a steel has a strength of approximately 800,000 pounds per square inch.

Evidently, then, for a steel subjected to dynamic stresses, we can safely increase its strength up to 80,000 pounds per square inch by the use of an increased carbon content; however, every additional increase in strength is obtained at the expense of the toughness. A further consideration is the fact that the hardness of the steel, and therefore the difficulty and expense of machining, increases with the increase in pearlite.

A little consideration of the above facts will show us that they are logical and what we should expect. The pearlite is composed of fine plates of pure iron strengthened and made rigid by cementite, which itself is intensely hard and strong, but is also extremely brittle.

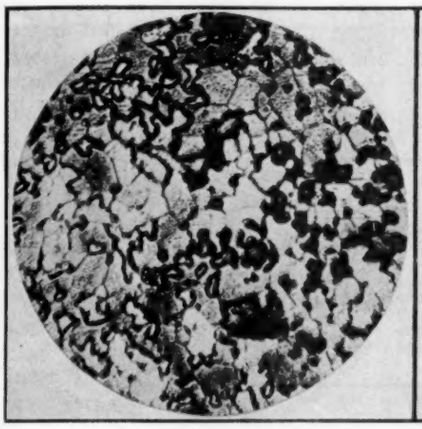


FIG. 10—MARTENSITE AND IRON, 0.20 PER CENT CARBON, QUENCHED FROM 1,375 DEGREES FAHR.
Magnification 150 diameters

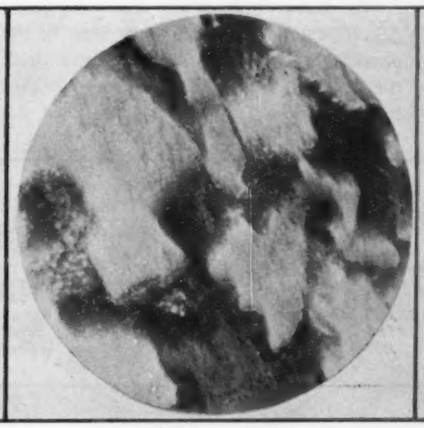


FIG. 11—MARTENSITE AND IRON
Magnification 1,200 diameters

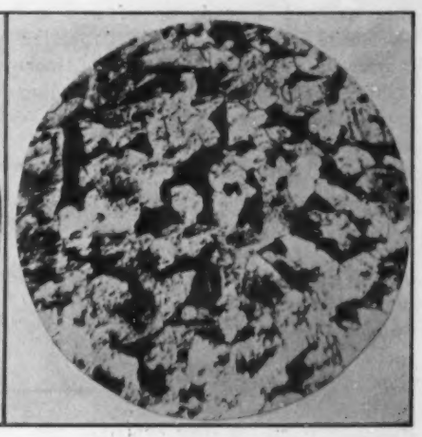


FIG. 12—MARTENSITE AND IRON, 0.20 PER CENT CARBON, QUENCHED FROM 1,440 DEGREES FAHR.
Magnification 150 diameters

The pearlite, then, as a mass is strong, but, due to the cementite in it, it is not as tough as pure iron. Pure iron compared to pearlite is weak but tough. A combination of the two will give characteristics consistent with the proportion of the constituents.

It is apparent that in order to obtain greater strength in the steel without increasing the amount of pearlite, or, what is the same thing, the amount of carbon, we could do at least three things: (1) increase the strength of the iron, (2) increase the strength of the pearlite, or (3) increase the strength of both. Practically, these are reduced to two, because anything which increases the strength of the iron also increases the strength of the pearlite to some extent, because of the iron in it.

This can be accomplished by adding to the steel some element or elements which will alloy with either the iron, the pearlite, or both, and increase their strength. A steel containing this extra element is known as an alloy steel. There are two classes of alloy steels: (1) those in which one or more of the normal impurities are made abnormally large, and (2) those in which one or more elements not normally present are added. To the first class belong silicon and manganese steels. To the second class, which is the more important commercially, belong nickel, chrome, chrome vanadium, chrome nickel, tungsten, and titanium steels.

As typical examples of the two methods of increasing the strength of steel we will consider nickel and chrome steels. Nickel forms a solution or alloy with the iron which is stronger than iron alone. Chromium replaces some of the iron of cementite, forming a carbide of chromium. The pearlite thus formed from the double carbide of chromium and iron is stronger and at the same time more tough than ordinary pearlite formed without chromium. The most widely used nickel steel contains 3.5 per cent nickel, while the common chrome steel has about 1 per cent chrome. Such a nickel steel will be about 20,000 pounds per square inch, and a chrome steel about 15,000 pounds, stronger than a simple steel of the same carbon content. At the same time the toughness of the nickel steel will be about the same as that of a simple steel, while for the chrome steel it will be a little greater.

It is clearly apparent, then, that the use of an alloying element to increase the strength of steel is better than to use carbon for the same purpose, as the increased strength is not obtained at the expense of the toughness.

It has been shown that the relation between strength and toughness in ordinary steel can be varied by changing the relative amounts, and also the strength or toughness of two substances composing it; namely, the pearlite and iron. In either case this must be done by adding something to the steel; in the first case, carbon, and, in the second, some alloying element.

Can not the relative amounts of the elements or their strength be changed by some process of heating?

Consider the same steel shown in Fig. 3. If we heat this to a temperature of 1,000 degrees Fahr. and suddenly cool or quench it in cold water, we will find that neither its physical properties nor its appearance under the microscope have been changed; if we increase the temperature to 1,100 degrees, we still find no change; nor will we detect any difference until we use a temperature of about 1,275 degrees Fahr. Fig. 10 shows a steel so treated. Comparing it to Fig. 3, we find that the iron is still present and in about the same amount, but the pearlite areas are more rounded. If we examine this structure under 1,200 diameters, the same magnification which we used for the pearlite in Fig. 1, we get a structure shown in Fig. 11. The white areas are the iron, while the dark areas represent what was originally pearlite.

This has now apparently coalesced, so that the original cementite and ferrite of which it was composed have merged into a single substance.

The real explanation of the change which has taken place is that the iron which originally composed part of the pearlite underwent an allotropic change at this temperature, and in its new form it is capable of dissolving to a solid solution the cementite with which it was in contact. This new solid solution is known as austenite, and by the sudden quenching, time is not given for the reverse allotropic change to occur completely. It cannot be entirely prevented, and the transition substance

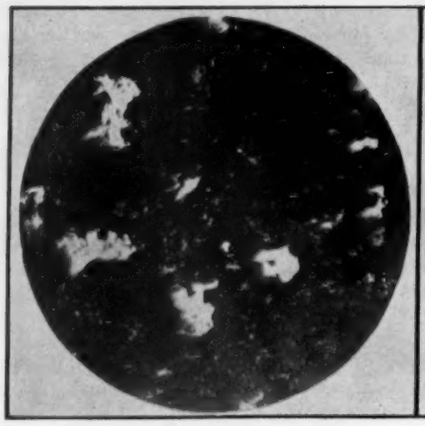


FIG. 13—MARTENSITE AND IRON, 0.20 PER CENT CARBON, QUENCHED FROM 1,525 DEGREES FAHR.
Magnification 150 diameters

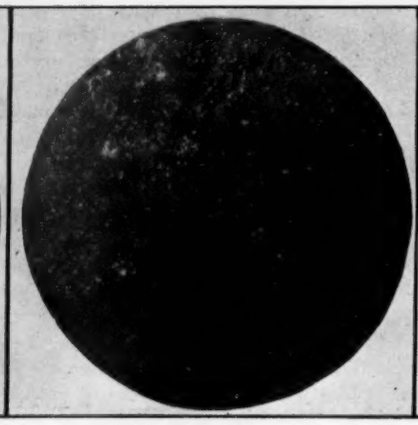


FIG. 14—MARTENSITE, 0.20 PER CENT CARBON, QUENCHED FROM 1,565 DEGREES FAHR.
Magnification 150 diameters

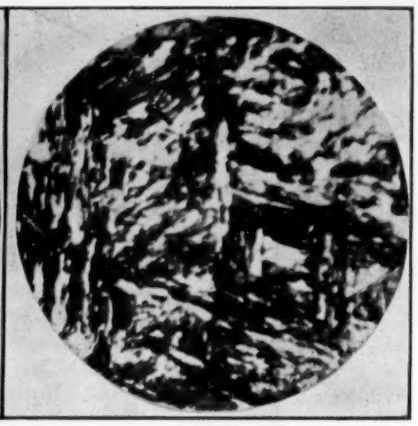


FIG. 15—MARTENSITE
Magnification 1,200 diameters

which we really obtain is known as martensite. Steel thus treated differs from untreated steel in one of its constituents, and is made up of iron and martensite instead of iron and pearlite. Martensite is much stronger but more brittle than pearlite. We should then expect that our treated steel should be stronger but less tough than the one not treated. The untreated steel of Fig. 3 has a tensile strength of about 55,000 pounds per square inch, and a reduction in area of 65 per cent. The same steel heat treated as just explained has a tensile strength of about 95,000 pounds per square inch and a reduction in area of about 30 per cent. Now these properties are very similar to those of a high carbon steel containing about 100 per cent pearlite or 0.90 per cent carbon. In other words, by a simple process of heat treatment we can obtain with a 0.20 per cent carbon steel the physical strength of a 0.90 per cent carbon, untreated steel.

We have just seen that at some definite temperature the pure iron in the pearlite went into a solid solution with the cementite. Possibly at a still higher temperature we could cause more of the contained iron to go into such a solution. Fig. 12 shows the structure of the same steel quenched from 1,440 degrees. It will be noted that the iron has decreased in amount, while the martensite has increased. Apparently, then, as we raise the temperature we increase the saturation point of the martensite for iron; just as in a water solution we can cause more sugar to dissolve by increasing the temperature, so we can here cause more iron to dissolve by increasing the temperature.

Fig. 13 shows the same steel quenched still higher from 1,525. At a temperature of 1,565 degrees all of the iron will go into solution and the quenched steel will consist of 100 per cent martensite. This is shown in Fig. 14. A higher magnification shows the martensite structure to be triangular, as in Fig. 15. Now by comparing the series showing increasing carbon contents in different steels, *i. e.*, Fig. 2 to Fig. 6 inclusive, with the series, Figs. 10-14, which represents the same steel subjected to an increasing temperature of quenching, it will be seen that they are very similar, in that the amount of iron constantly decreases until it becomes zero, while in the increasing carbon

Physical Tests of Treated and Untreated Steel

Untreated Steel			Heat Treated Steel, 0.20 per cent carbon.		
Pearlite, per cent.	Strength, pounds.	Toughness.	Martensite, per cent.	Strength, pounds.	Toughness.
25	55,000	65	25	95,000	30
50	75,000	55	50	98,000	40
75	90,000	45	75	100,000	50
100	105,000	35	100	105,000	55

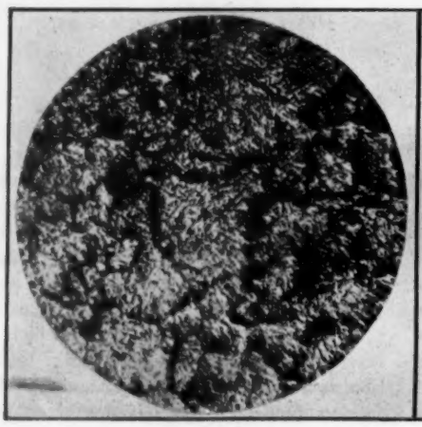


FIG. 16—MARTENSITE AND TROOSTITE, FIRST STAGE
Magnification 150 diameters

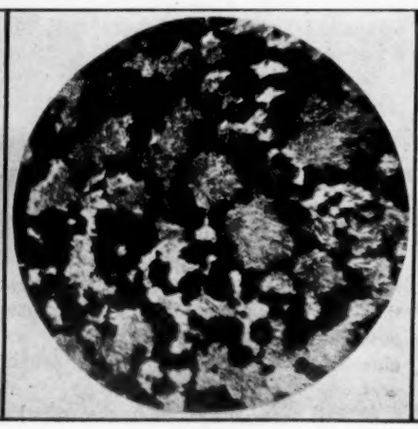


FIG. 17—MARTENSITE AND TROOSTITE, SECOND STAGE
Magnification 150 diameters

FIG. 18—CEMENTITE NEEDLES
Magnification 350 diameters

series the pearlite increases to 100 per cent and in the increasing temperature series the martensite increases to 100 per cent.

If we make physical tests on the increasing temperature series, we find that the strength increases, beginning with the temperature of the first change, until final absorption of the iron, while the toughness also increases if the carbon is low. The accompanying table illustrates this more fully:

Untreated Steel.

Pearlite Per cent.	Strength pounds.	Toughness.
25	55,000	65
50	75,000	55
75	90,000	45
100	105,000	35

Heat-Treated Steel, 0.20 Per Cent Carbon.

Martensite Per cent.	Strength pounds.	Toughness.
25	95,000	30
50	98,000	40
75	100,000	50
100	105,000	55

The temperature at which the pearlite first changes is known as the lower critical temperature, and is designated by the symbol "A_1." The temperature at which the absorption of iron is complete is known as the upper critical temperature, and is designated as "A_3." There is an intermediate critical temperature, which we will not consider.

It is apparent that of two steels containing different percentages of carbon, and therefore different percentages of pearlite, the one containing the more pearlite will have less iron to dissolve, and therefore the temperature of final absorption will be lower. In other words, the upper critical temperature is lowered by an increase in the carbon content. If the steel is all pearlite, *i. e.*, contains 0.90 per cent carbon, its upper and lower critical temperatures will coincide.

With some steels the best results are obtained by quenching just at the absorption point, while with others a higher temperature is necessary. The metallurgist must know the amount of this variation for different types of steels.

The heat treatment of an alloy steel is exactly the same in principle as that explained above for plain carbon steels, the alloying elements giving increased strength as well as increased toughness to the heat treated steel, in the same manner as they did in the untreated steel.

From the foregoing it is apparent that a steel heat-treated to bring out high strength will consist of 100 per cent martensite, no matter what amount of carbon there was originally present, nor whether alloying elements were there or not. Evidently, then, martensite will have a varying composition. Under the microscope there is very little difference in appearance, no matter what the composition. Since martensite is really formed from a solution of cementite in iron, a high-carbon steel will form a stronger solution than a low-carbon one, just as we can have a strong or weak solution of salt in water. Alloying elements in the martensite do not cause any difference in its structure any more than a little sugar would cause a difference in the appearance of a salt-water solution. These alloying elements, however, have a very decided influence upon the position of the critical temperature; for example, 0.1 per cent manganese lowers the upper critical temperature 6 degrees, while it has practically no effect upon the lower critical temperature; 0.1 per cent chromium raises the lower critical temperature 4 degrees when nickel is absent, but with nickel present it raises it only 3 degrees, but in neither case does it have any appreciable influence upon the upper critical temperature.

The business of the metallurgical engineer is to know absolutely the influence of all elements upon these critical temperatures in the alloys of steel.

In general, these martensites made from a steel containing more than 0.2 per cent carbon have not enough toughness for their strength, and to remedy this the steel is given a second low heat, commercially known as a drawing heat, which allows a certain amount of transformation to take place in the martensite, and reduces its strength but increases its toughness. By varying the final heat, an unlimited number of combinations of strength and toughness are available.

Some of these transformation stages have definite characteristics. Fig. 16 shows one stage. The lighter-colored material is martensite, while the black spots are known as troostite. In Fig. 17 the same constituents are shown, but in a more advanced state.

As the drawing temperature is raised still higher, the microstructure of the steel becomes extremely fine and it is known as sorbite. This is really an imperfect pearlite which has become more intimately mixed with the iron. Broadly summarized, the process of heat treatment consists in transforming an alloy from a mechanical mixture of two substances into a homogeneous solution of a single substance. This very fact gives to a heat-treated steel one of its most valuable advantages over the untreated steel; namely, its ability to withstand repeated shocks or vibrations, or, as it is popularly expressed, "fatigue-resisting power." The reason is obvious: an alloy composed of two dissimilar substances has mechanical boundaries between them. This fact is a source of weakness under repeated stresses, the reasons for which are more or less complicated. An untreated steel contains these boundaries; a correctly heat-treated steel does not.

There is a still further advantage based upon a different consideration. A steel with a tensile strength of, say,

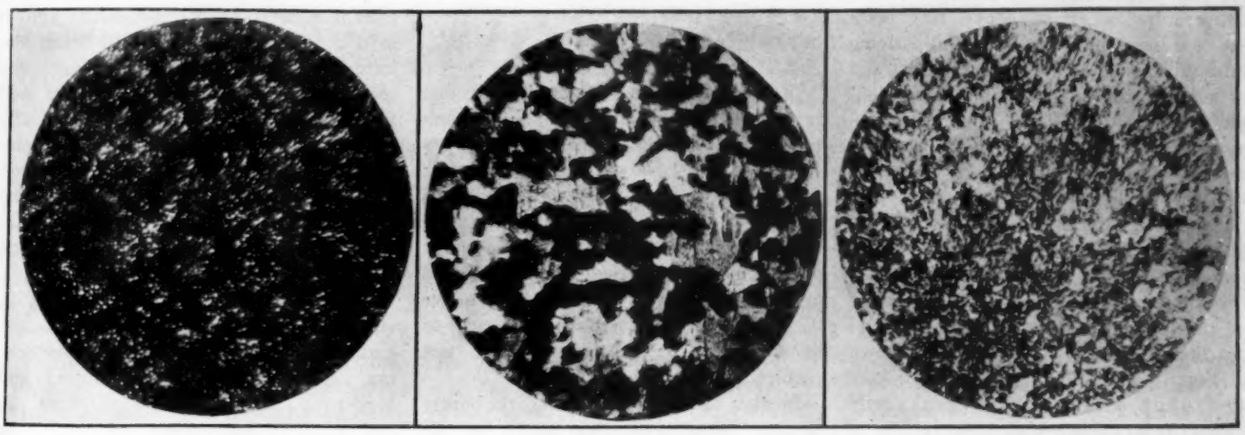


FIG. 19—CEMENTITE GLOBULES
Magnification 350 diameters

FIG. 20—CORE OF CARBONIZED STEEL, SINGLE QUENCH
Magnification 150 diameters

FIG. 21—CORE OF CARBONIZED STEEL, DOUBLE QUENCH
Magnification 150 diameters

60,000 pounds per square inch, if subjected to repeated reverses of stress of any magnitude, will finally break after a definite number of these reversals; as the magnitude of these stresses approaches the actual strength of the steel, the number of reversals necessary to cause a break rapidly decreases; as a consequence of this fact, a comparatively slight increase in the strength of a piece of steel will increase far out of proportion, its resistance to fatigue break. Therefore it is frequently desirable to heat-treat a piece of steel to give it an added factor of safety under shock or alternate stresses, even though its static factor of safety is ample.

In supersaturated steels—that is those containing more than 0.90 per cent carbon — we have present cementite and pearlite. Most tool steels belong to this class. In the heat treatment of such a steel the pearlite changes to austenite at the same temperature which we found for an undersaturated steel. As the temperature is raised above this point the excess cementite begins dissolving into this austenite, just as the iron did in a lower carbon steel, until at a definite temperature all of it is dissolved, and we have, as before, austenite. The cementite is more sluggish in dissolving into the austenite than the iron, and the reaction requires more time to complete. As we have previously seen, cementite is extremely brittle and hard; it occurs usually as sheets in the pearlite or thin envelopes surrounding grains of pearlite. These two types are shown in Fig. 18 and Fig. 7. A piece of tool steel which previously had been slowly cooled from above the temperature at which the last of the cementite went into solution will contain the cementite in one of these two forms.

If it is hardened at the lowest possible temperature its pearlite will be changed to martensite, while its cementite will be unchanged. These sheets or envelopes of cementite will cause the steel to be extremely brittle, and is a source of many of the troubles of the steel user.

Now if we quench from above the upper absorption point we get rid of this cementite, but the steel is somewhat softer because of its absence. The structure of the steel has also been coarsened by the high temperature, which causes it to be brittle. Now if the coarsened steel is again reheated slightly above the lowest hardening temperature, the cementite will be precipitated out of the solution, but, instead of being in sheets or plates, it will occur as fine dots, which give extremely good wear and have practically no effect of brittleness. A steel thus treated is shown in Fig. 19. This same arrangement of cementite can be formed by heating the steel to just above the lowest hardening temperature and holding at this temperature for some time.

Carbon in Steels

In an alloy steel the influence of carbon is reduced, and this reduction is greater the higher the percentage of alloy. For structural purposes the carbon of alloy steels rarely exceeds 0.50 per cent; those containing less than 0.25 per cent are usually used for parts which are to be surface-hardened by the carbonizing process, and above 0.25 per cent for parts which are to be subjected to stresses which do not require a hardened surface.

In the carbonizing process the outer surface of a low-carbon steel has its carbon contents raised by heating in contact with carbonaceous material. The depth of penetration of this high-carbon shell and also the percentage of carbon it contains are functions of the carbonizing material used and the temperature and time of carbonization in general; the outer surface should be a supersaturated steel, and therefore its treatment comes under that of tool steel.

To produce a correctly heat-treated, carbonized article we have four functions to consider: (1) the chemical analysis of the steel; (2) the carbonizing material; (3) the time of carbonization, and (4) the temperature of carbonization. These should be adjusted so that the upper absorption point of the iron of the core shall exceed that of the cementite of the case. Under these conditions, if the steel is quenched from above the absorption point of the core this will be entirely martensitic, and at the same time the cementite sheet or net of the case will be absorbed, so that it will also be martensitic.

Now in order to obtain the maximum hardness on the surface this cementite must be precipitated, as shown in Fig. 19, by a low quench from the hardening temperature. During this second quench the iron of the core will also be precipitated out in practically the same globular form, with this difference: there being more excess iron than excess cementite in the core, the iron will precipitate in larger particles and will not have the characteristic globular appearance.

A comparison of the difference in structure of the core of a piece of carbonized steel with a single hardening heat and this double refining and hardening heat is shown in Figs. 20 and 21. In both cases we have the same amount of martensite (black) and iron (white) present, but the mixture is much more intimate and fine in Fig. 21. This increased toughness of the finished steel is considerably greater.

A Discussion of Heat Treatment Results

By H. V. Wille

THE theory of heat treatment has been understood by metallurgists for many years, but this has been largely applied in a practical way only during recent years. Some years ago Dr. Sargeant, who is now connected with the Crucible Steel Co. of America, conducted a small experiment which showed in an interesting way the basis of all heat treatment of steel.

He heated in a flame of a Bunsen burner a thin plate until he obtained a red spot. Upon removal from the flame he showed that this spot gradually decreased in brightness until a certain temperature was reached, whereupon the fall of the temperature was arrested and the spot glowed with a marked increase in luminosity, showing that some internal change had taken place in the molecular structure of the steel which caused the elevation in temperature in a manner similar to that produced by the combination of sulphuric acid and water.

If the steel is quenched at this temperature it will retain its molecular structure, and if examined it will be found that steel so quenched is of maximum hardness, with a decreased loss of ductility for that particular grade, and, furthermore, the molecular structure will not be changed unless the steel is again heated above this critical or recalescence point. It therefore follows that a steel so quenched can be annealed below this temperature without change in the molecular structure, but with a great increase in ductility. A steel so treated has a much higher elastic limit and a much greater reduction of area

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than steel which has been subject to the ordinary annealing process.

The sole advantage of all of the modern high-grade steel consists solely in an increase in the elastic limit, so that the designer is enabled to reduce the weight or size of any detail by the use of a higher unit stress, or to increase the factor of safety by the retention of the same unit stress as in a straight annealed steel.

Extremely high elastic limits can be obtained by the use of the various alloys to assist the hardening effect of carbon, such as nickel and chromium, or of the various tertiary alloys, such as chrome nickel, chrome vanadium, or chrome titanium. Steel can be produced having an elastic limit of 150,000 pounds with sufficient ductility to prevent failure by shock, by the use of some of these alloys with proper heat treatment, so that engineers are able to design parts with unit stress as high as 100,000 pounds per square inch, in place of about 20,000 pounds per square inch for a straight carbon annealed steel. It is hard to grasp the great benefits derived from this enormous increase in the elastic limit. The possibilities of the use of straight carbon, heat-treated steel have not been utilized to the fullest extent. This condition results from the fact that metallurgists write the specifications to which steel is purchased, and the chief object of the metallurgist is to secure a steel of maximum ductility. The designing engineer, however, is not concerned about the ductility of the steel, but desires a steel having a maximum elastic limit; but the manufacturer is unable to produce this steel for the designer because of the ductility requirements on the specification.

James E. Howard made extensive experiments in testing rotating shafts. These results showed that the high-carbon, heat-treated steel withstood as many rotations as the more ductile alloy steel, so that it would appear that equally good results could be obtained by the use of the cheaper high-carbon, heat-treated steel as is obtained from the use of the more expensive and more ductile alloy steel. These views seem to be borne out both by the experience of automobile builders and railroads. In the principal automobile factories in France, about ten years ago, such parts as axles, steering gears, etc., were made from a very low carbon ductile steel, but the experience of a few years demonstrated an inordinate number of failures from this grade of steel, and the automobile builders began to use the extremely high grade alloy steel, which gave better results.

The railroads met with the same experience, and the first experiments in the use of steel in substitution for iron were made with low-carbon steel having the same physical properties as wrought iron. A large number of failures followed this substitution, but they were eliminated by the use of steel having a tensile strength of about 80,000 pounds per square inch. This grade of steel is successfully used in railroad service, and there is a gradual tendency to go to steel of even higher carbon having a tensile strength of about 110,000 pounds per square inch.

Why Tool Steel Prices Have Gone Up

By E. C. Kreutzberg

AMONG the problems confronting the metal working industries as a result of the changed conditions brought on by the European war, one of the most interesting is the situation in tool steel. The consumption of tool steel is said by leading steel makers to be of much greater proportions now than before the war, due to the heavy requirements of the war munition manufacturers and to the enlarged requirements of practically all machine shops. Prices on ordinary carbon tool steel now are about 20 per cent higher than previously, while quotations on high speed steel have advanced 300 per cent.

These advances are due to the higher cost of labor and of practically all the materials used in steel making. Prices on pig iron and coke are higher, and crucibles and all refractory materials are selling considerably higher than a year ago. Then, too, quotations on the various alloying elements used in special steels, almost all have been advanced. Vanadium has gone up and now is quoted at $2.25 to $2.50, compared with $2, the former quotation. Ferro-manganese has been advanced from around $40 to $100 a ton and ferro-silicon has gone up, for the first time in several years, from around $71 to $73 to approximately $85 to $87 on closely held lots. Chromium has gone up about 100 per cent and prices on cobalt are about 25 per cent higher.

The most sensational advances, however, have affected the price of tungsten, which is the essential element in the manufacture of high speed steel. Prices on this metal have advanced from around 75c per pound to approximately $5 per pound. While the United States for several years past has been a very large producer of tungsten ore, its requirements have been so large that both the ores and the metal have been imported from foreign countries. In 1913, the metallic content of tungsten ore produced in this country amounted to something in excess of 900 tons. During the same year, 661 tons of tungsten and ferro-tungsten and ore containing approximately 240 tons of tungsten were imported from abroad. In 1914 the domestic industry was curtailed greatly as a result of the war, so that the ore produced in the United States was equivalent to approximately 575 tons of tungsten. During the year the imports of tungsten and ferro-tungsten were 192 tons, while the ore imported had a content of approximately 160 tons. About the beginning of this year, the demand for tungsten, which had fallen off as a result of the war, suddenly was stimulated by the same cause and since then there has been a continual scarcity of the metal. Our principal European sources of supply have been cut off—that from Germany through the blockade of her ports and from England by reason of the embargo established on exports of this metal. Simultaneously, ore shipments from Straits settlements, India and Portugal were cut off.

It is estimated that the output of tungsten in this country now is approximately 100 per cent greater than before the war. Tungsten ore is being produced in this country on a larger scale than ever before, and large shipments of ore are being brought in from Peru, Bolivia and Chile. Considerable tungsten ore also has arrived of late from Japan and China. It is believed that imports of tungsten ore from South America alone this year will total between 300 and 350 tons. Thus, calculating the approximate metallic content of the ore, it is considered likely that domestic production from domestic and foreign ores now is at the rate of approximately 1,200 tons for the year, which is nearly 300 tons in excess of the total supply in 1914, but more than 600 tons short of the supplies in 1913, during which year the demand for tungsten was about normal.

Makes Swedish Type Diesel Engine

THE POWER equipment used by Captain Roald Amundsen in his dash to the South Pole, aboard the ship FRAM, *is now being manufactured by the McIntosh & Seymour Corporation, Auburn, N. Y., which has acquired rights therefor from the Aktiebolaget Diesels Motorer, Stockholm, Sweden. The corporation has an interesting 500-horsepower stationary engine at the Panama-Pacific Exposition, San Francisco.*

AN INTERESTING Diesel engine installation at the Panama-Pacific Exposition, San Francisco, is that of the McIntosh & Seymour Corporation, Auburn, N. Y., which exhibits a 4-cycle, 4-cylinder stationary engine of 19-inch bore and 23.87-inch stroke, developing 500 brake horsepower at 165 revolutions per minute. The engine has a continuous load capacity of 525 horsepower with a 20 per cent overload capacity for momentary demands. Its fuel consumption is said to be as follows:

Brake Horsepower.	Oil, Pounds per Brake Horsepower Hour.
567	0.405
502	0.407
397	0.412
262	0.449
126	0.652

The oil consumed has a specific gravity of 0.855 and 33 degrees Beaume at 60 degrees Fahr., a flash point of 190 degrees Fahr., and is rated at 19,266 B. T. U. per pound or 137,463 B. T. U. per gallon.

The engine has a single box type of frame, as shown in the accompanying illustrations, and is 13 feet 2 inches high from floor to top. A crane hook clearance height of 18 feet 9 inches is necessary for drawing out the pistons. The extreme width of the engine is 14 feet 6 inches and the diameter of its flywheel is 12 feet 2 inches. The length of the engine, for belt drive, is 30 feet 2 inches, and for direct connection to a generator, 30 feet 10 inches. The flywheel weight is carried on outboard bearings, as shown in Fig. 1, which also shows the water cooled exhaust manifold and two-stage attached air compressor, direct connected, at the rear end of the engine. Chain oiling devices instead of slip rings are employed on the main bearings; the piston and piston pin being oiled by a Mollerup pump which is driven by an eccentric off the cam shaft. The crank pins, measuring 10¾ x 11 inches, are oiled by means of rings, the oil being delivered by a pump to the bearings.

Bearing pressures per square inch vary from 200 pounds for the piston pin and 500 pounds for the main bearings, to a momentary pressure of 1,200 pounds for the crank pin. A cam shaft drive through two sets of spiral gears actuates the valve mechanism. The cam shaft is of the built-up type, with a shaft of steel and cams of cast iron. Thirty-five pounds of cooling water is used per brake horsepower.

Starting air is contained in the two larger bottles shown at the side of the engine in Fig. 2, at 750 pounds pressure per square inch. The air used to break the crude oil fuel into a fine spray and inject it into the combustion chamber is contained in the smaller bottle, at from 750 to 820 pounds pressure per square inch. Fig. 2 also shows the valve rocker-arms on the cylinder heads, as well as the brass tubes housing the injection valves. Part of the oil distribution system is visible at the side and base of the engine.

The McIntosh & Seymour Corporation, which has taken over the plant and organization of the McIntosh & Seymour Co., has acquired the manufacturing rights for this engine from the Swedish Diesel Engine Co. (Aktiebolaget Diesels Motorer), Stockholm, Sweden, for the United States and other American countries. It is now undertaking the manufacture of four-cycle stationary engines from 40 to 1,000 brake horsepower, high - speed four-cycle engines of smaller power principally for marine use, two-cycle stationary engines up to 3,000 horsepower, and two-cycle reversible marine engines. It is interesting to note that this type of Diesel engine was chosen by Captain Roald Amundsen for the ship FRAM, used by his expedition which discovered the south pole.

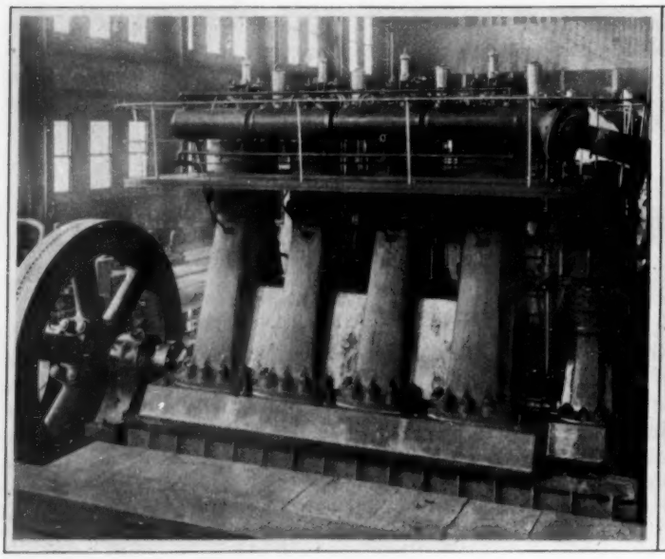


FIG. 1—EXHAUST SIDE OF 500-HORSEPOWER SWEDISH TYPE DIESEL ENGINE

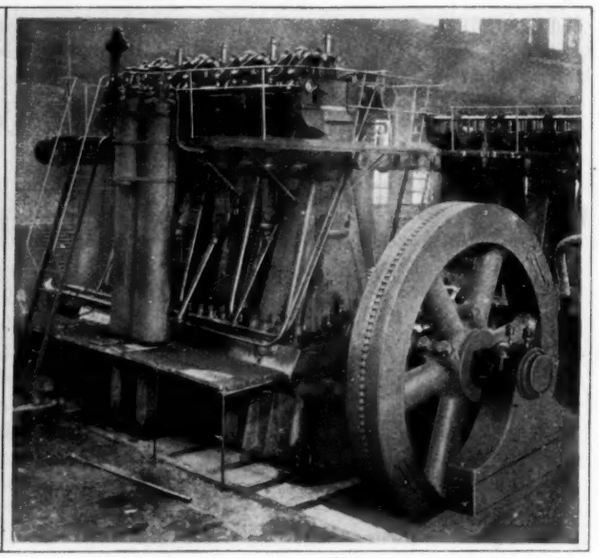


FIG. 2—CAM SIDE OF DIESEL ENGINE, SHOWING AIR BOTTLES AND VALVE MECHANISM

First prize in each of 12 classes of saws and tools was won by Henry Disston & Sons, Inc., on their exhibit at the Panama-Pacific exposition. The Disston company won first place in each of the classes which it entered.

How to Detect Phosphorus in Steel

A BRITISH investigator has found that an etching reagent composed of cupric chloride, magnesium chloride, hydrochloric acid and alcohol applied to test specimens reveals the presence of the impurities in a striking manner. This reagent also indicates unequal distribution of various alloying metals in steel. Extreme caution, however, is advised, lest certain alloys be mistaken for phosphorus-rich steel.

By W. T. Stead

MANY years ago I noticed that very dilute aqueous solutions of copper chloride deposited copper unevenly on polished surfaces of steel; some portions remained bright, while on others copper was deposited and appeared red. On experimenting on steels with ghost lines, in which it had been proved by the heat-tinting process that the phosphorus was in segregation, the action was most erratic; sometimes the copper deposited on the purer portion, and at other times it deposited on the parts rich in phosphorus. Some time ago, when asked if I had used copper solutions to etch steel, I

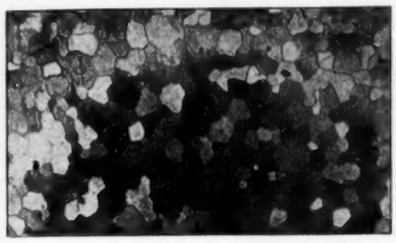


FIG. 1—SPECIMEN OF IRON RICH IN PHOSPHORUS, ETCHED AND THEN HEAT TINTED TO BROWN AND PALE YELLOW

replied in the foregoing terms, but subsequently reinvestigated the action of copper salts on steel. I substituted alcohol for water, omitting the ferric chloride, and instead of immersing the specimen in the reagent, I simply covered the specimen with the exceedingly dilute alcoholic cupric solution. I then found that the copper invariably first deposited on the purer portions freest from phosphorus, and so sensitive was the selective action of the reagent that differences of less than 0.01 per cent phosphorus, and irregular distribution of phosphorus in all wrought irons and steels could be detected. This reagent is made by mixing:

	Grams
Cupric chloride	10
Magnesium chloride	40
	Cubic Centimeters
Hydrochloric acid	20
Alcohol to make up to	1,000

The salts are dissolved in hot water and the solution made up to 1,000 cubic centimeters with alcohol. Magnesium chloride is not necessary, but better results are, if anything, obtained by having it present.

The specimens are simply covered with a thin layer of the reagent and must on no account be immersed in a bath of the liquid. The layer of liquid, after remaining on the surface for one minute, is shaken off and a second layer dropped on the surface and left there for the same period. This procedure is repeated as often as it is found desirable. The specimen is washed with boiling water, then with methylated spirits and shaken to remove the spirits from the surface, the heat imparted by the boiling water rapidly evaporating the last traces of alcohol.

The copper is usually left as a hard coherent layer, and is not readily removed by rubbing; indeed the specimens may sometimes be repolished by roughed chamois leather without disturbing the deposited copper. The reagent not only indicates variations of phosphorus, but by progressive etching one can get a very good idea as to the degree of difference between the phosphorus in different portions of the same metal. If the reagent be applied in successive portions and the difference in the proportion of phosphorus be slight, as stated above, the copper invariably precipitates on the purer portion first; but on repeated application the copper gradually deposits also on the parts richer in phosphorus, and after many applications of the reagent the whole surface, including the phosphorized parts, becomes coated with copper. If, however, the phosphorus be very much concentrated in one or more parts, these remain perfectly bright and free from copper even after ten applications of the reagent.

New Method is Sensitive

In order to show the relative sensitiveness of the new method as compared with the old heat-tinting process, a piece of open hearth iron, manufactured by the Shelton Iron, Steel & Coal Co., Ltd., was phosphorized in one single spot by making a small hole in it and filling it with iron phosphide, after which the bar was heated to whiteness to enable the phosphorus to melt and diffuse into the surrounding iron. After cooling, the surface of the bar was ground down to below the point where the original drill hole had penetrated so as to admit the examination of the iron below, into which the phosphide had diffused. The surface after polishing was first etched so as to develop the crystalline structure of the iron; it was then heated until the phosphorized part was brown and the surrounding iron pale yellow. It was then photographed. The section was repolished and treated with one application of the new reagent, after which it was again photographed. The photographs of the same area, after developing in the manner described, are placed side by side and are reproduced

FIG. 2—SAME SPECIMEN AS SHOWN IN FIG. 1 AFTER ATTACK BY CUPRIC REAGENT

in Figs. 1 and 2. It will be observed that one application of the new reagent left the whole of the phosphorized parts perfectly free from any copper deposit, and also that the phosphorus in diffusing preferentially travels between the junctions of the crystal grains. These branches or ramifications diminish in phosphorus as they extend outwards, as was proved by the continued application of the reagent, for the copper began to be deposited on their terminations, and eventually they were completely covered, leaving only a round white disc. On continuing the attack the white disc became smaller and smaller, until eventually only a small spot in the center remained free from deposited copper. This gradual deposition of the copper commencing at the extremities and extending towards the center indicates that the phosphorus was in the greatest concentration at the center and the least at the ends of the branches.

Heat-tinting was not sufficiently sensitive to detect the very dilute solid solution of the phosphorus in the intergranular ramifications, but was capable of

*Portions of a paper read before the British Iron and Steel Institute.

indicating that the center of the disc contained more phosphorus than the outer part.

J. H. Whiteley, in a paper read before the Cleveland (England) Institute of Engineers, described a method for detecting the parts richest in phosphorus in steel castings. According to Mr. Whiteley, his reagent is made by dissolving 0.04 grams copper oxide (CuO) in six cubic centimeters of strong nitric acid (HNO_3), and making up to 200 cubic centimeters with methylated spirits. In working with this reagent Mr. Whiteley prefers to etch very deeply and repolish afterwards. His reagent, like all other cupric reagents, acts upon certain parts, dissolving portions of them; therefore, on slightly repolishing, the parts least acted upon take a bright polish, whilst the hollow places from which the metal has been removed by the etching remain dark.

Harry Brearley, when discussing Rosenhain and Haughton's paper on their new etching reagent, suggested the use of an extremely dilute solution of ferric chloride in the neutral or slightly acidified condition. Judging from the illustrations accompanying his remarks it would appear that his reagent gives the same indications as the cupric reagents, but there can be little doubt that if the parts etched are invariably darkened by a deposit of copper, the contrasts by use of the cupric reagents are more pronounced. Brearley's ferric chloride reagent seems to give similar results to those obtained years ago by myself with exceedingly dilute acid solutions.

Other Elements Than Phosphorus Give Similar Indications

The action of the copper etching reagents depends on the relative solubility of different parts of the metal in dilute acids. The parts most soluble are the first to decompose the copper salt. As iron or steel always contain some parts more soluble than others, the copper appears first on the more soluble portions. If one part contained 0.01 per cent phosphorus and the other 0.02 per cent, the copper would appear first on the former; similarly, if one part contained 0.1 per cent and another 0.2 per cent, it would precipitate first on the purer part. The method therefore gives only differential and not actual results, with this difference, however, that the higher the phosphorus the slower the attack.

In seeking to determine whether other elements than phosphorus in variable solid solution would give similar indications, alloys of iron with nickel, copper, arsenic, chromium, tin, and antimony were prepared. The reagent proved that each of the added elements when in appreciable proportion is unequally distributed in the alloys, for the metals contain parts more soluble in dilute acid than others and precipitate copper from the alcoholic reagents the more rapidly.

A rail containing 1 per cent copper gave indications of unequal distribution, and on testing it was found to contain on the outer part of the head 0.79 per cent copper, and in the center 1.373 per cent, proving that copper does segregate just like phosphorus and sulphur, an important result, for there is some conflict of opinion on the question. The rail I examined contained about 0.6 per cent carbon, and it seems probable that this may have some influence, for I have shown that while pure iron and copper alloy in all proportions, the presence of much carbon leads to the production of two conjugate solutions which separate from each other before solidification occurs, one containing an excess of copper, the other an excess of iron.

Eutectiferous Mixtures Not Homogeneous

It may be accepted that mixtures of metals or metalloids which are eutectiferous or tend to form conjugate solutions or to separate into parts, one of which contains more of one of the constituent elements than the other, will not be homogeneous and will have parts more soluble than the other portions.

Carbon and iron yield a eutectic and eutectoid and separate into iron and carbide of iron. Copper deposits on the iron in advance, leaving the carbide white. Martensite embedded in and surrounded by iron, if as hardenite, does not readily precipitate copper but if diluted as it is in steels containing about 0.13 per cent carbon quenched from 850 degrees centimeter, copper is liable to be deposited equally on the free iron and martensite. Alloys of nickel and iron contain primary crystallites differing in solubility according to the rates at which they solidify.

Tin and iron form conjugate solutions, and the tin-iron liquid which is last to freeze in steel is less soluble than the primary crystallites. Some of the chromium nickel carbon alloys, etched by the cupric reagent, might easily be mistaken for steel very high in phosphorus.

It is important that these facts should be stated and the limitations of the cupric reagent be recognized, for unless the metallographist is warned of this, he will be liable to come to wrong conclusions, and condemn even the best steel when he applies it.

In conclusion, I think it must be admitted that the alcoholic cupric reagents of Rosenhain and Haughton, my own, and others, are of great value in detecting irregularities in commercial carbon steels and irons.

Tool Shortage Produces New Builders

By R. H. Jones

The prevailing unprecedented demand for machine tools has brought about an interesting situation. At this time there are numerous concerns engaged in tool building that in years past directed their activities along totally different lines. Each week marks the advent of new companies into the field, some, unfortunately, hoping to benefit only by the temporary profits found in supplying foreign demand, which has paid, and is paying handsome bonuses for immediate delivery, others with the intention of instituting a permanent business.

Among concerns that have lately placed new machines upon the market is the Oliver Machinery Co., Grand Rapids, Mich., builder of wood-working machines. This company has been awarded several contracts by foreign governments for a new heavy duty engine lathe. Specifications had been prepared and a certain amount of preliminary work accomplished on this tool previous to the declaration of hostilities abroad, but owing to the increasing demand for tools, added effort was put forth and the machine brought out at an earlier date than originally contemplated.

The Oliver Co. is specializing on a 16-inch engine lathe, the brief details of which are as follows: Swing over shears, 17½ inches; swing over carriage, 10¼ inches; length of bed, 7 feet 2 inches; diameter of front spindle bearing, 3 inches; length of front spindle bearing, 5 inches; counter shaft pulley speeds, 180 and 220; feed range, per inch, 9 to 132; spindle speeds, 14 to 335 revolutions per minute; feeds, 32; angular travel of compound rest, 3⅞ inches; cross slide travel, 14 inches; height of bed, 13 inches.

The Chicago Pneumatic Tool Co., Chicago, has issued a booklet, describing its new flat disc valve. The advantages claimed for this valve are its simplicity, independence of its plates in action, the difference in the tension of the springs on the inlet and discharge valves according to the density of the air handled, and its adapability.

The American Rolling Mill Co. has been awarded a grand prize for its exhibit of American ingot iron at the Panama-Pacific Exposition, San Francisco. The award was based on five characteristics, rust resisting properties, chemical purity, electrical conductivity, welding qualities and enameling properties.

Developing an Acid-Resisting Alloy

PLATINUM is rapidly becoming rarer and more expensive. The demand of scientific experimenters and others for an alloy of high corrosion-resisting qualities as a substitute for the precious metal in chemical research led to the investigations which Mr. Parr describes in this article. Nickel, chromium, copper, molybdenum and tungsten are the predominating elements of "illium", as his discovery has been named.

By S. W. Parr

THE increasing cost of platinum in recent years has emphasized the desirability of finding a substitute for that metal, especially in the construction of those forms of scientific apparatus having relatively large areas exposed to the corrosive action of acids and gases. Enamels have their uses and possibilities. Moreover, great advances have been made in the resistivity and other properties of such materials. The studies here discussed, however, have had to do with the production of a substance having, in addition to its chemical behavior, those physical properties which would render it suitable for use where density, strength and working properties are essential. For securing these physical properties we would naturally look to a metallic substance or compound. Where we add the chemical property of resistivity to corrosion, we have very greatly complicated the problem unless we confine ourselves to the so-called noble metals. In its ultimate form, therefore, the question simply resolves itself into this: Is there a possibility of combining base material to form a noble alloy? When we attempt to answer this question from the theoretical or scientific standpoint, we are at once impressed with the fact that there is very little available data or information that will be of assistance to us. We may theorize, perhaps, most naturally along this line: There are certain metals which are electro-positive toward certain other metals. Conversely, these other metals are electro-negative towards the first. Now may it not be that by a suitable adjustment of the two, a ratio may be found, the electro-positive and electro-negative properties of whose constituents would neutralize each other, reducing the electric potential to zero?

In the future we may possess such data, in terms of mass, molecule or otherwise, which will make it available for use in actual practice. But even so, the ever-present impurities and their effect, often in minute percentages, the modifications attendant upon the formation of solid solutions and the multiplication of unknown factors following an increase in the number of complexes, combine to indicate that for some time at least we will be obliged to carry on our studies in this field very largely along the purely empirical line of universal experiment. This latter method has been the one most followed in these studies, though it is fair to say that the theoretical considerations above referred to have served a useful purpose in laying out the general procedure. To discuss briefly work pertaining to non-corrosive properties, it may be said that a degree of resistivity has been attained which was hardly thought possible at the outset. The unit of reference for measuring the amount of corrosion was adopted as follows: A standard disc of the alloy was prepared, having 10 square centimeters of surface. This was submerged for a given length of time, usually 24 hours, in a solution, approximately 25 per cent of which consisted of nitric acid. The loss in weight was calculated to the amount which would be represented for an area of 100 square centimeters per hour. A small casting of simple form was secured, from which the test piece showed a loss in weight, of 0.03 milligrams. A casting of more difficult form was secured, weighing about 10 pounds, the test piece from which gave an equally high degree of resistivity. In the last seven castings of similar size, six out of the seven standard discs did not show a weighable loss after contact with the nitric acid for 24 hours.

It will hardly be profitable to go into a detailed account of the difficulties encountered in reaching this end.

The chemical analysis of such an alloy is not simple, and has been made the subject of special study referred to elsewhere. The analytical

(*Continued on page* 1010*b*)

From a paper read at the annual meeting of the American Institute of Metals, Atlantic City, N. J., Sept. 28 to Oct. 1, 1915.

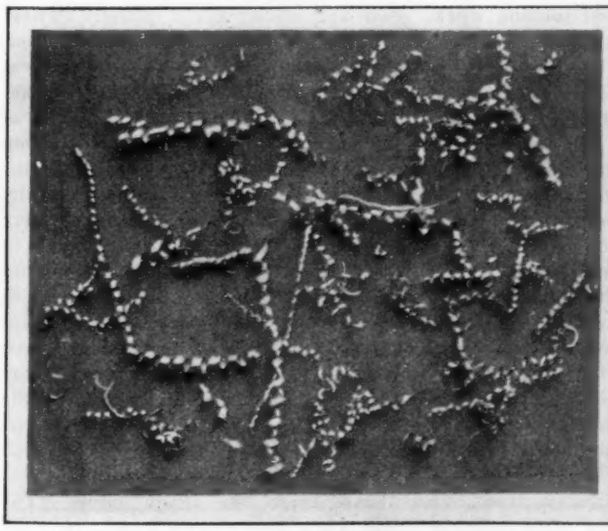


FIG. 1—TURNINGS FROM ACID-RESISTING ALLOY

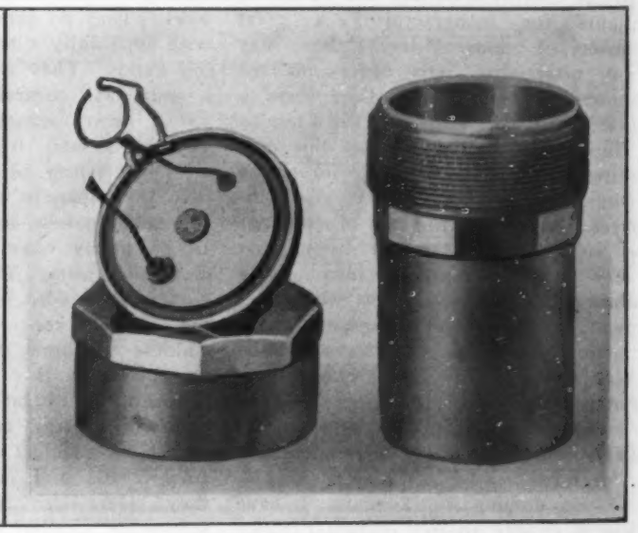


FIG. 2—CASTINGS MADE WITH "ILLIUM" ALLOY

The Chinese Machine Shop of Today

AN INTERESTING letter from an American traveler in the celestial republic-empire indicates that the efforts of the French, British and other nations to develop the Chinese machine tool market and create a demand for modern equipment had not progressed far even before the war. There seems to be an excellent opportunity here for American manufacturers to familiarize the natives with their product.

PRESENT-DAY conditions in the machine tool industry of China are interestingly set forth in a letter received recently by Charles E. Hildreth, general manager of the National Tool Builders' Association, Worcester, Mass., from Frank A. Foster, now traveling in the Celestial Empire and studying the situation there from the standpoint of the American manufacturer. Mr. Foster's communication is as follows:

War conditions are reflected even in this far distant land. The borrowing power of China in Europe has been cut off and that has had a natural tendency to turn her attention to developing her own resources, which, of course, is a good thing for China. The recent drastic action of Japan in her demands on China, another reflection of the war, has had a still further stimulating effect on native effort. A boycott of anything of Japanese origin has been started which is having a far-reaching and disastrous effect on Japan's commerce. There does not appear to be any organized movement, but it is rather a natural revulsion of feeling against a neighbor nation which, it is felt here, under the guise of friendship and desire for peace, stole all she could lay her hands on and threatened to come back for more.

Efforts are being made to produce in China those things which were formerly obtained from Japan. There are many inquiries going about, as to the cost of installing and operating plants for manufacturing a great variety of goods. Although these may not materialize into orders in the immediate future, still, they show a good spirit on the part of the Chinese. They seem to be getting the data together so as to be ready for action when the psychological moment arrives. At present the rate of exchange is so very high against China that very few will venture into buying abroad. Those industries which depend more on native resources are pushing ahead as well as could be expected. By and by, if nobody has entered the field, the Chinese will be forced or encouraged to enter those fields which could be preempted for Americans.

Since coming to Tientsin, I have had a chance to get in better touch with commercial work. I have looked up all the machine shops I could find, both native and foreign. There are two British shops fitted to do fairly good-sized work such as steam engines, boilers, etc. These were working mostly on steam fittings for heating systems to be installed in some of the numerous large buildings being erected here. They report work very dull. A French shop in the French concession is fitted up finely with good French machinery of all descriptions, both for metal and wood work. They do general jobbing work, with apparently a main line of plumbing goods. They were quite busy on a municipal contract. They seemed to be pretty enterprising, while the British seemed to be the reverse, although I may be mistaken.

In the Japanese concession I found a small Japanese shop which seemed to be pretty busy on steam engine and boiler work. Their methods were somewhat crude, but ingenious. In the British concession I found a Chinese machine shop also working on power plants. They had perhaps a dozen English lathes, a few upright drills of a very crude type, and a planer or two. Their methods were slow, crude and inefficient, although they seemed to be very busy. A somewhat smaller, but more interesting Chinese shop was found in the Chinese city. Here they had half a dozen lathes of an old and English gap type. In fact, all the lathes I have seen here, except in the French shop, were of the English gap style. In this shop they take all kinds of contracts, large or small, and meet all emergencies with a great deal of ingenuity. The compound steam engine which drives this shop is of the proprietor's own design and make. His shop is lighted by electric lights from his own plant.

All these shops have small foundries. In the Chinese places and in one of the British, they have the small Chinese cupolas, holding less than a ton charge. These cupolas are about 4 feet high and set on a sort of clay-lined iron bowl, mounted on trunnions and having the spout on the front. The blast is taken on the side above the trunnion. When the iron is ready to pour the whole cupola is tipped forward by a long lever at the back. The hand ladles are shallow and have wooden handles. In some cases the blast is obtained by a square piston blower worked by six or eight men stepping back and forward for a stroke of some 4 or 5 feet. They are quite skillful in making large thin cast iron pans. I have seen pans so made that were not over 3/16-inch thick at the center and tapering off evenly to 1/16-inch at the edges, 3 feet in diameter.

Besides these power-driven shops, there are numerous small shops with two or three lathes, a crude drill or two and sometimes a planer. These are all driven by hand power, consisting of a good husky coolie, turning a crank on a countershaft, having a heavy flywheel. In the case of the planers there is a shaft passing through the bed and geared to the bull wheel, reversing being done by the crank. In many places I have seen men and boys boring holes in thin material with the aid of a ratchet drill and "old man", holes that with a good upright drill would be finished by one or two turns of the feed wheel. In these smaller shops they seemed to be making various textile machines of a simple character, especially foot power looms. I have seen perhaps 20 of these shops and, no doubt, there are many more. The looms are used mostly locally in small

(*Continued on page* 1010b)

The Market of Cathay

CHINA has been "waking up" for quite a while now. It will not be so long before the gigantic empire-republic of Cathay is thoroughly wide awake and ready to enter the international race for herself. She has already shown countless signs of amicability to the United States. We cannot afford to be anything but the very best of friends with China. We need her friendship and we need her trade. The commercial embassies constantly coming and going between the two huge republics, the hundreds of bright young Chinese attending our universities and technical schools, augur well for future relations. But we must develop trade interests, and one of the best ways to do this is to teach the willing and intelligent Chinese to use our tools, for reasons of mutual benefit. Mr. Foster's letter sounds this note clearly and strongly.

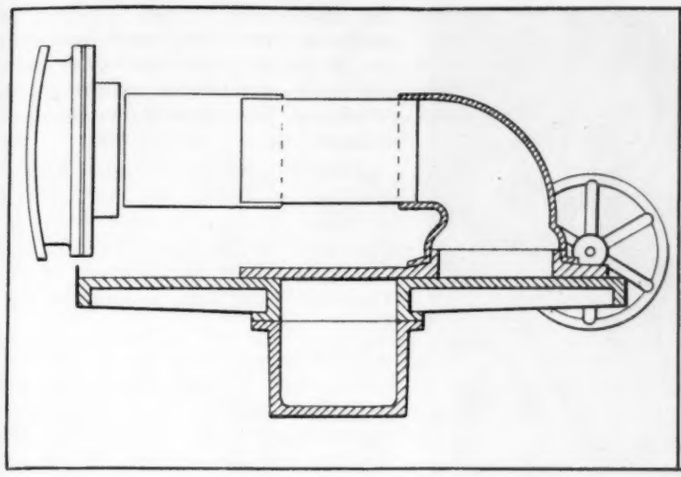


Fig. 1—Kennedy Stove Burner

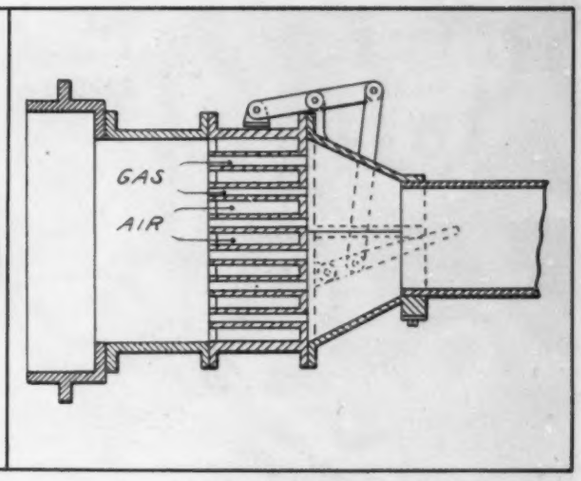


Fig. 2—Boynton Gas Burner

Utilization of Blast Furnace Gas

SIX DIFFERENT types of stove burners are described by Mr. Diehl in this, the second of a series of three articles. Comparative test data are given for several of the various classes of burners now in use. The requirements of the combustion chamber of a stove are explained, and lucid comparisons serve to illustrate the essential points in the securing of efficient stove operation by operators of blast furnace plants.

By A. N. Diehl

THE COMBUSTION chamber of a stove is long and therefore tends to produce a good mixture before the checkers are reached. However, by completely mixing the air and gas in the burner before the ignition point, the maximum flame temperature is obtained, and the total path of the gases through both combustion chamber and checkers is utilized to the fullest extent for efficient heat absorption.

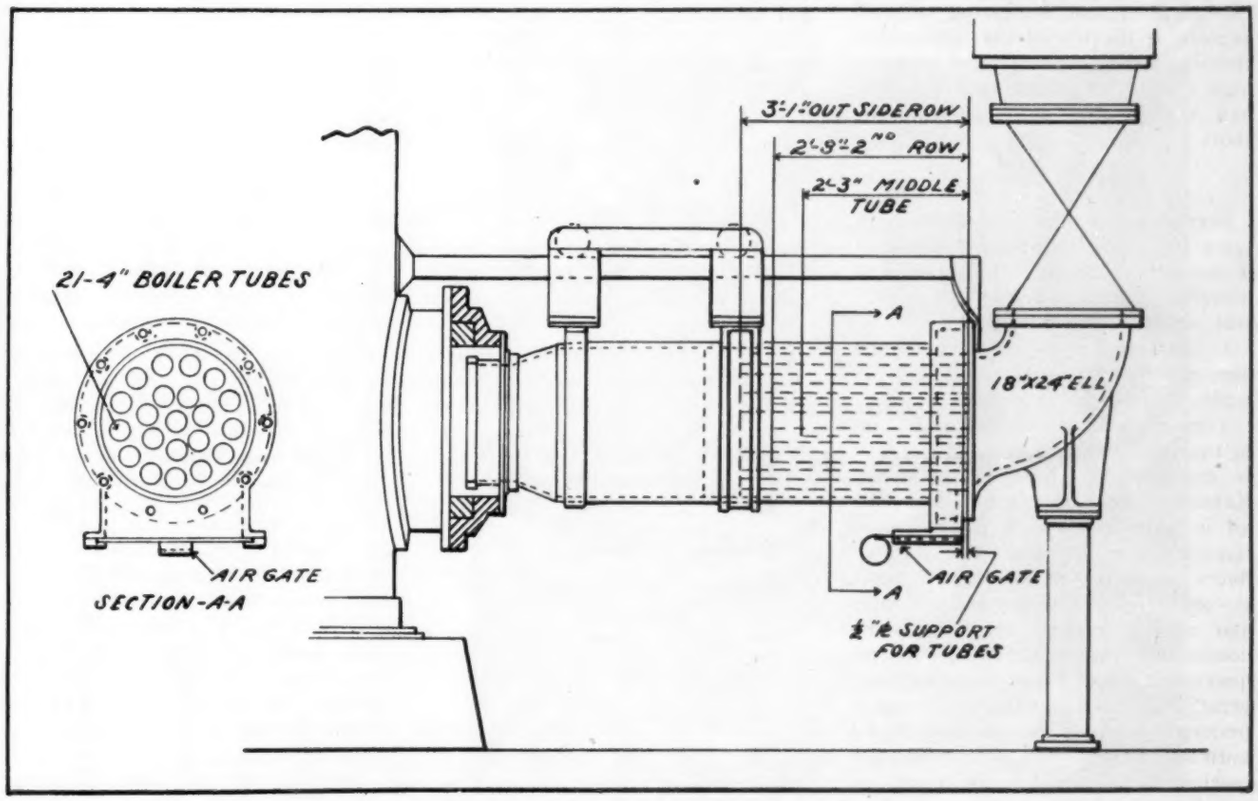


FIG. 3—LANDGREBE BURNER FOR BLAST FURNACE GAS

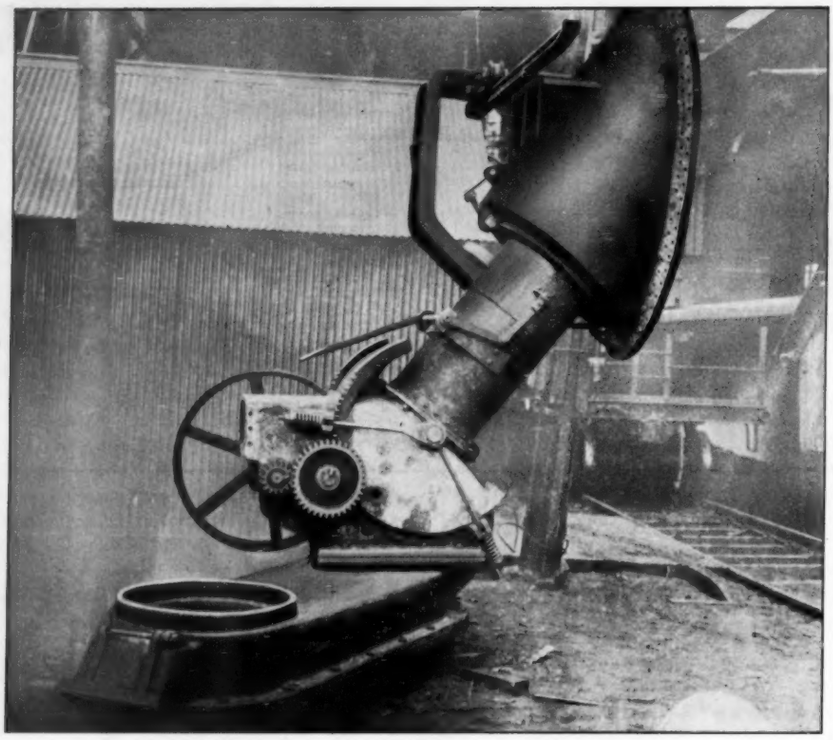


FIG. 4—STOVE BURNER AT EDGAR THOMSON WORKS

The temperature curves of a stove, as given in A. E. Maccoun's paper on "Blast Furnace Advancement", illustrate the point mentioned and show an average temperature of 1,900 degrees at the burner opening, reaching a temperature half way up of 2,150 degrees and decreasing to 2,040 degrees at the top of the combustion chamber. With this form of burning, high CO losses would have resulted, had the combustion chamber been short.

Types of Burners

Several stove burners of various types in regard to which information is available will be enumerated and described under headings of their general characteristics.

1.—Rectangular or circular nozzle burner with air added around it or by separate air doors or both.

This is the burner in common use in nearly all blast furnace stoves and is exampled by the Spearman and Kennedy burner, shown in Fig. 1. The air is taken in through the clearance space around the burner and through doors in other parts of the stove circumference. The gas and air meet and mix in passing up through the combustion chamber. If the correct quantities have been admitted, the great length of combustion chamber permits the practical completion of burning before the checkers are reached. Extracts from tests of stoves, using the common burner, made at Duquesne and Edgar Thompson works, clean gas being used in both, appear in the following table:

Item	Duquesne	Edgar Thompson
Type of Stove	2-pass central Comb. Cham.	2-pass
Size of stove, feet	21 x 96	22 x 100
Heating surface, sq. ft	39,920	51,192
Cubic contents, sq. ft	17,974	8,894
Air blown per minute at 62 degrees, cu. ft	40,580	37,744
Temperature hot blast, degrees Fahr	1,076	1,200
Temperature stack, degrees Fahr	612	537.5
Time on gas, minutes	198.75	172.25
Time on blast, minutes	64.0	60.0
Furnace gas analysis, per cent CO_2	13.06	11.94
Furnace gas analysis, per cent CO	25.78	24.84
Furnace gas analysis, per cent H_2	3.69	4.45
Furnace gas analysis, per cent N_2	57.47	59.77
Flue gas analysis, per cent CO_2	21.30	18.08
Flue gas analysis, per cent O_2	2.90	4.93
Flue gas analysis, per cent CO	.8	0.
Flue gas analysis, per cent N_2	75.0	76.99
Heat absorbed by blast (efficiency), per cent	64.58	58.04
Sensible heat lost in flue gas, per cent	22.22	23.41
Unconsumed CO loss, per cent	4.52	0.
Radiation, unaccounted for, etc., per cent	8.78	18.45

In these tests the stack analyses are good and the temperature comparatively low. Regulation, however, would give better results, such as the following at the Wisconsin Steel Co.:

Type of stove	Kennedy 2-pass.
Size of stove, feet	22 x 90
Heating surface, sq. ft	33,000
Air blown per minute at 52 degrees, cu. ft	35,000
Temperature hot blast, degrees Fahr	1,165
Temperature stack, degrees Fahr	761
Time on gas, minutes	236
Time on blast, minutes	73
Furnace gas analysis, per cent CO_2	15.1
Furnace gas analysis, per cent CO	23.6
Furnace gas analysis, per cent H_2	3.0
Furnace gas analysis, per cent N_2	58.3
Flue gas analysis, per cent CO_2	25.0
Flue gas analysis, per cent O_2	1.0
Flue gas analysis, per cent H_2	0.
Flue gas analysis, per cent N_2	74.0
Heat absorbed by blast (efficiency), per cent	61.5
Sensible heat loss in flue gas, per cent	26.5
CO loss in flue gas, per cent	0.
Radiation and unaccounted for, per cent	12.0

The stack analysis here itemized is excellent. The high stack temperature is the result of insufficient heating surface, since the combustion is as good as could possibly be obtained in regular operation.

2.—Rectangular or circular burner with air conducted into the gas jet by means of pipes or other openings, illustrated in the Landgrebe burner, Fig. 3, developed at the plant of the Tennessee Coal, Iron & Railroad Co., Ensley, Ala.

This burner consists of 21 four-inch boiler tubes through which the gas is admitted. The outer row of tubes is the longest, the center tube the shortest and the middle row is cut half-way between, so that the gas flowing through the central tube starts burning before any of its neighbors. Surrounding these tubes is an air space formed partly by the outer shell of the burner and partly by a sliding sleeve, which connects the main burner with the stove door frame when the door is removed. The ends of the gas tubes are placed about 2 feet from the door frame. Air is admitted at the back of the gas tubes surrounding them, and at the ends of the latter meets the gas, at which point mixing takes place. To eliminate the necessity of disturbing the relation of gas and air supply, if it became necessary to increase or decrease the flow of gas, a separate gas valve was supplied in the pipe

connection to the gas main. This gas valve is simply a cylindrical valve covering a port and consisting of special mechanical features to prevent clogging and leakage and to insure ease of operation.

Thus, by this valve, the supply of gas can be regulated at will without disturbing the burner proper. Suitable slides, etc., are provided for regulating admission of air into the air chamber of the burner.

Burners of the above description were provided for two new two-pass side combustion stoves, 22 x 110 feet, which were built and put into service in January, 1912. A series of tests was conducted on these stoves while they were still new and clean, and the results of these tests, though variable, were, on the whole, quite satisfactory. The results follow:

Type of stove		2-pass.
Size of stove, feet		22 x 110
Air blown per minute at 62 degrees, cu. ft.		49,700
Temperature hot blast, degrees Fahr.		1,200
Temperature stack, degrees Fahr.		437
Time on gas, minutes		205
Time on blast, minutes		55
Furnace gas analysis, per cent.	CO_2	10.92
	CO	32.72
	H_2	1.04
	N_2	54.56
	CH_4	.16
Flue gas analysis, per cent.	CO_2	24.40
	O_2	1.70
	CO	0.
Heat absorbed by blast (efficiency), per cent		74.1
Sensible heat loss in flue gas, per cent		13.2
CO loss in flue gas, per cent		0.
Radiation and unaccounted for, per cent		12.7

Both stack analysis and temperature are excellent and as good as could be obtained with any type of burner, since they are very close to the theoretical possibilities. The secret of success in a burner of this type seems to be the design of air ports sufficiently large to take care of the quantities required for complete combustion.

3.—Burners which subdivide air and gas into a series of streams but do not mix in the burner.

A stove burner, answering this description, has been developed at the Edgar Thompson works, Carnegie Steel Co., as shown in Fig. 4. This burner consisted of the usual burner base box carrying the burner base. This burner base is a casting containing the gas and air admission passages, and ports for the burner, and having a cylindrical seat or face. The burner seat consists of a casting having a cylindrical face fitting onto the corresponding face of the burner base and free to rotate over the same. This casting is provided with gas and air ports, and passages, gear teeth for rotating the same, and flanges for supporting the burner nose or nozzle. The burner nozzle, bolted to the burner seat casting, consists of two concentric barrels, 3 feet long, forming the gas and air passages. The central or gas passage, 14½ inches in diameter, contains a spirally twisted vane, twisted through about one and one-half turns; the outer or air passage, 4½ inches wide, contains four spiral vanes, making one-half turn each and twisted in the opposite direction from the gas vane. The vanes run the full length of the barrel. The entire nozzle is built of sheet iron and boiler plate. Sliding lengthwise on the outside of the barrel is a short nozzle, actuated by a system of levers and links, and used to complete the connection between the burner and the branch connecting to the combustion chamber. The burner seat and nozzle are rotated in a vertical plane by means of a hand wheel and gears, the center line of the burner barrel being practically vertical when the gas is off, and making an angle of about 49 degrees with the horizontal when the gas is on the stove. A steel casting is lined with fire brick, leaving a conical opening into the combustion chamber; the central axis of the cone lies in a vertical radial plane through the center of the stove and makes an angle of about 49 degrees with the horizontal, giving as nearly a vertical admission of the flame to the combustion chamber as is possible for a burner at the side of the stove and with the construction of stove tested.

The gas main supplying gas to the burner was provided with a mushroom type, hand-controlled shut-off and control valve, and a butterfly valve actuated by a pressure regulator.

The following test figures show a decided gain in efficiency over that of the old form of burner mentioned before:

Type of stove		2-pass.
Size of stove, feet		22 x 100
Heating surface, sq. ft.		51,192
Cubic contents, cu. ft.		8,894
Air blown per minute at 62 deg., cu. ft.		34,926
Temperature hot blast, deg. Fahr.		1,339
Temperature stack, degrees Fahr.		469
Time on gas, minutes		167.8
Time on stack, minutes		60
Furn. gas analysis, per cent.	CO_2	12.09
	CO	25.48
	H_2	3.54
	N_2	58.89
Flue gas analysis, per cent.	CO_2	23.42
	CO	1.17
	O_2	.57
	N_2	74.84
Heat absorbed by blast (efficiency), per cent		69.21
Sensible heat lost in flue gas, per cent		15.62
Unconsumed CO loss, per cent		6.11
Radiation, unaccounted for, etc., per cent		9.06

Complete tests of these stoves and burners will be discussed with data of results in an addition to this paper. Another example of this form is

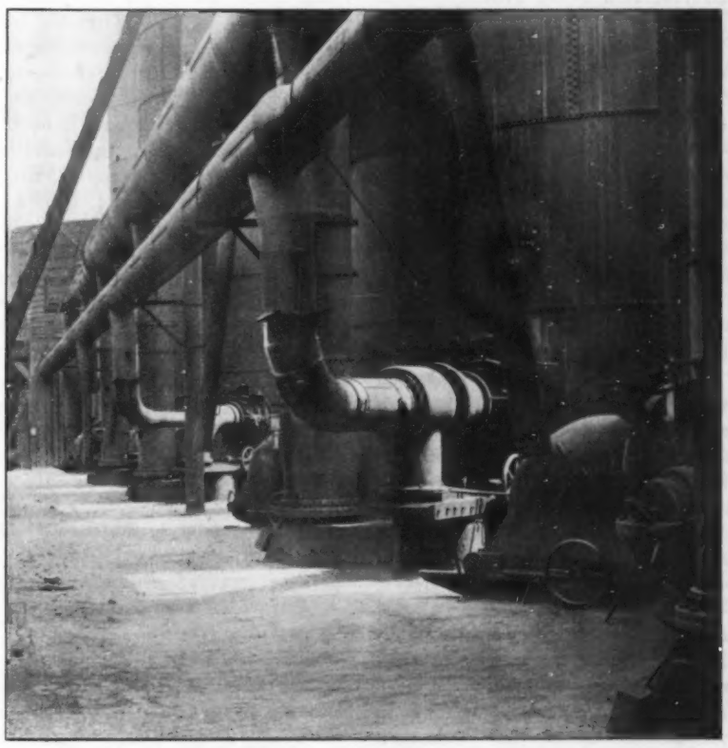


FIG. 5—WISCONSIN PRESSURE STOVE BURNER

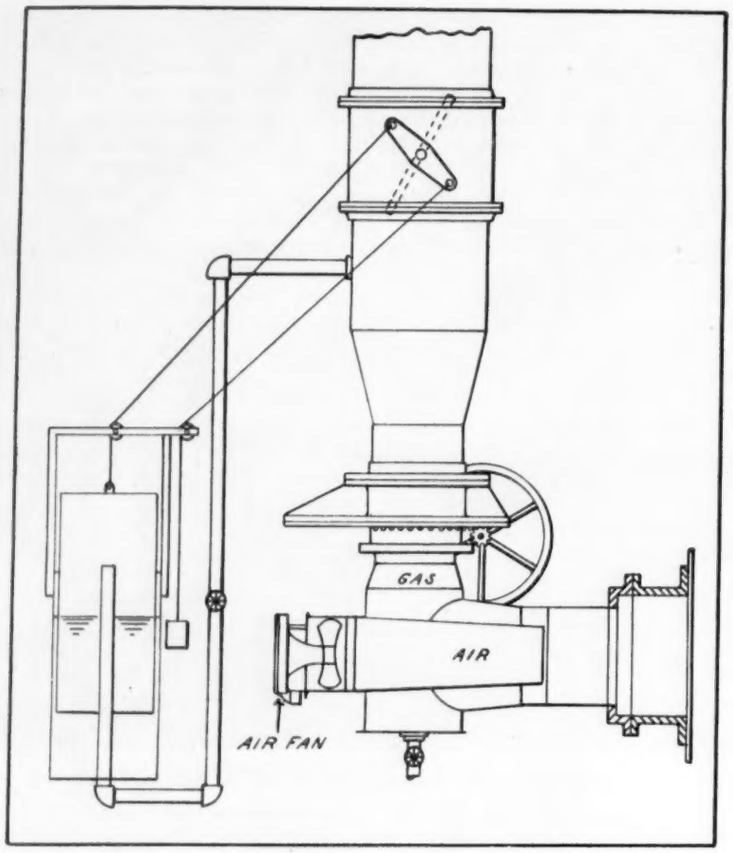


FIG. 6—FORCED DRAFT STOVE BURNER

found in the Boynton burner in use at the Lorain works, of the National Tube Co., and shown in Fig. 2.

Air and gas are admitted in horizontal layers, as shown in the sketch, this stratification being produced with the idea of obtaining intimate mixture of air and gas at the point of admission. Just to what extent this object is accomplished cannot be stated, since no test results are available.

4.—A burner in which air is aspirated by means of an air jet at high pressure, as in a steam jet blower, the air from both sources mixing with the gas in the burner.

The Freyn induced draft burner, Fig. 7, is of this type. It consists of a main gas pipe, into which two injector nozzles in series are placed. Into the outside nozzle is inserted a small pipe, through which high pressure air is supplied. This air operates as the aspirating force, and by its regulation the entire air supply is controlled. This makes a device which is easy to control, but not more free from the necessity of control than any other mixing burner.

5.—Burners through which all of the required air is forced and completely mixed with the gas before the ignition point.

Burners of this description are in use on the stoves of the Wisconsin Steel Co., at South Chicago, and the American Steel & Wire Co.'s Central furnaces, Cleveland.

The Wisconsin burner, Fig. 5, consists of a circular gas passage, in the back of which is placed an air nozzle, the air being supplied under pressure by a fan. The old burners on these stoves gave excellent results, as mentioned before. However, the heating surface was insufficient, and an additional 4,000 square feet of surface was placed in the combustion chamber. After this change, the draft proved insufficient, and forced draft was resorted to in order to furnish to the stove the required quantity of heat. By this means the capacity of the stove was increased, the efficiency being somewhat higher, as shown by the following test extracts, the stack temperature being lower, but the flue gas analysis essentially the same:

Type of stove		Kennedy 2-pass.
Size of stove, feet		22 x 90
Heating surface, sq. ft.		37,000
Air blown per minute at 62 degrees, cu. ft.		35,000
Temperature hot blast, degrees Fahr.		1,273
Temperature stack, degrees Fahr.		598
Time on gas, minutes		55
Time on blast, minutes		148
Furnace gas analysis, per cent	CO_2	15.1
	CO	23.6
	H_2	3.0
	N_2	58.3
Flue gas analysis, per cent	CO_2	24.8
	O_2	1.3
	CO	0.0
	N_2	73.9
Heat absorbed by blast (efficiency), per cent		69.4
Sensible heat lost in flue gas, per cent		18.6
CO loss in flue gas, per cent		0.0
Radiation and unaccounted for		12.0

The forced draft stove burner, Fig. 6, at the Central furnaces, designed by C. A. Orr, consists of an air nozzle inserted in the gas passage. The nose of this nozzle extends to within about 30 inches of the stove connection, and extends back from the downtake a short distance, in which position is placed a 16-inch turbo blower, which runs at a constant speed and therefore furnishes the required volume of air at a given rate. In order to insure a correspondingly constant gas volume, a gasometer-controlled damper is placed in the gas downtake about 10 feet above the burner. Complete test data for this installation is not available, but the following figures indicate good combustion results:

Time on gas, minutes		120
Time on blast, minutes		90
Temperature of blast, degrees Fahr.		1,200
Temperature of stack, degrees Fahr.		680
Stack analysis, per cent	CO_2	25.5
	O_2	1.7
	CO	0.0
	N_2	72.8

An approximate heat balance would be:

Heat absorbed by blast (efficiency), per cent	65.0
Sensible heat loss in flue gas, per cent	23.0
CO loss in flue gas, per cent	0.0
Radiation and unaccounted for, per cent	12.0

6.—Burners to which air and gas are supplied after being perfectly mixed in a fan which draws in air on one side and gas on the other, discharging the mixture into a common outlet.

An arrangement of this kind is being developed at the present time, but no specific information is available, so it is impossible to speculate on its merits or shortcomings as a mixing burner.

The combustion chamber of large proportions was originally designed primarily as a receptacle for the flue dust carried in rough gas, and secondarily as a necessary aid to combustion under primitive methods of burning. It was also considered advisable to have the hottest checkers at the top, where material strains are smallest, but no doubt, by suitable precautions in design, this factor

could be eliminated. The following points should be observed:

First.—Clean gas should be used when possible.

Second.—Large heating surfaces should be exposed as an aid in lowering stack temperatures.

Third.—Equal drafts and blast distribution over the entire checker area are essential to good practice.

Fourth.—All gas should be consumed in the combustion chamber. The closer the complete combustion is to the burner the better heat exchange is possible.

Fifth.—It is best to add both gas and air at only one point, through the burner, and control them there. Gas and air have channeling tendencies when entered separately.

Sixth.—Forced draft will facilitate flame intensity and act in such manner as to make the combustion of more gas possible in the stove than under atmospheric conditions. If the stove is sufficiently large, considerable advantage can be derived by this method.

Seventh.—It is advisable to make daily flue analyses and have a technical supervision of the combustion.

Active Demand for Motor Cars

Automobile manufacturers in Detroit, Lansing, Flint, Jackson and other cities of Michigan report a very active demand for motor cars and at least 50 per cent of the factories are running night shifts in order to keep close to the demand. In Detroit, there is a particularly keen trade in motor trucks and the manufacturers in this line report that business will undoubtedly continue at a high level for some months.

The Packard, Ford, Cadillac, Studebaker, Paige, Chalmers and Hudson companies are working particularly strong while the Hupmobile concern reports that it is finding a lot of new business to take the place of the orders lost because of the European war. In Lansing, the Olds and Reo companies are working very heavily and the Reo reports that there is a particularly big demand for its trucks. The Flint and Chevrolet companies in Flint are running on heavy overtime without being able to catch up with the demand.

Pittsburgh Office.—Ernst & Ernst, auditors and public accountants, have opened an office in the First National bank building, Pittsburgh. R. F. Marburger, for a number of years identified with the Cleveland office, is in charge of the Pittsburgh branch. F. M. Polliard, former assistant cashier

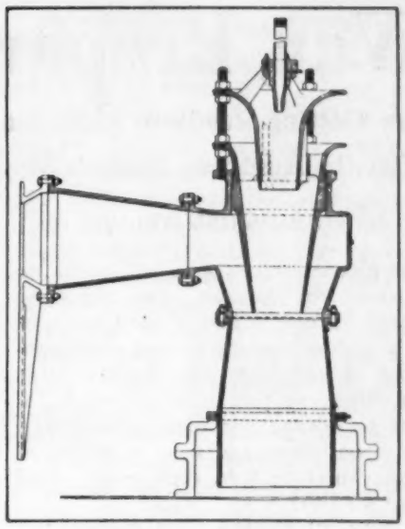


FIG. 7—FREYN INDUCED DRAFT STOVE BURNER

of the Exchange National Bank of Pittsburgh, is contract manager of the Pittsburgh office of Ernst & Ernst.

Will Erect Factories

Remington Arms & Ammunition Co., Bridgeport, Ct., has plans under way for the construction immediately of another group of factory buildings that will be double the size of the present huge plant on Boston avenue in that busy city. Twenty-six five-story buildings, it is reported, are included in the proposed operations. The plans include the purchase of the new almshouse and other city property north of Boston avenue.

The Stewart Construction Co., turned over to the company last week the completed plant in Boston avenue, consisting of 14 five-story brick and steel factory buildings and five two-story foundry buildings of the same type of construction. The contractor started building the plant March 9 of this year and in eight months it completed the biggest single building operations ever undertaken in the United States. More than 3,500 men were employed continually on the job, and at times as many as 50 carloads of materials were received in a single day.

The Stewart company, will begin at once the construction of 148 houses for the Remington company, on the tracts recently purchased between Boston and Barnum avenues in that city.

The Sharon, Pa., plant of the American Steel Foundries, Chicago, will resume operations the latter part of this month. The plant has been idle many months.

Shell Contracts

Amounting to Many Millions Distributed in Canada

Toronto, Nov. 16.—The last of the new orders for shells for the British war office, amounting in all to $80,000,000, has been given out. No official information has been published as to where these orders have been placed, but it is understood that they have been widely distributed. In the meantime, numerous unverified reports as to large contracts secured by some of the leading companies are in circulation. The Nova Scotia Steel & Coal Co. is stated to be one of the principal beneficiaries, the figure being put as high as $15,000,000, which is probably a considerable exaggeration. One of its contracts is stated to call for the weekly delivery of 5,500 of the largest type of shell forgings for a year. In addition, the company will take on a portion of the orders for large shell forgings given to other concerns. The Steel Co. of Canada is also credited with having obtained extensive orders for both large and small shells, and has commenced to install the new machinery and equipment required at its Hamilton plant. The Canada Cement Co. will install an electric furnace for the manufacture of the steel required to fill its shell order and will buy up scrap extensively. The National Steel Car Co., of Hamilton, has an order for $500,000 worth of shell forgings. The Imperial Steel & Wire Co., of Collingwood, Ont., will supply wire and goods for the trenches to the value of $5,000,000.

The munitions committee has fixed the price of steel for ammunition at a price not to exceed 3½ cents per pound, including forgings. General Bertram, of the munitions committee, states that the prices at which the latest contracts have been let were in some cases lower than those prevailing in other countries where shells are being manufactured. So much steel will be required on current and future contracts that its importation will be necessary and the government is considering the question of admitting it duty free. An important clause in the contracts provides that should the war be terminated in a short time, the war office will pay for special equipment which may have been installed and for the time put in on the work and cancel the contract.

Sir Frederick Donaldson, the Woolwich arsenal expert, who has returned to England with General Mahon, is understood to have prepared a report favoring the establishing of a plant for the manufacture of heavy ordnance in Canada.

In Time of War, Prepare for Trade

Importance of This Country Getting Ready to Fight for Its Share of the World's Business After the European Nations Stop Fighting

BY DANIEL WELLS

IF ALL one's neighbors are engaged in a free fight, what is best for one to do; stand and look on, or go about one's business to see that one does not get into the same trouble?

Those neighbors of yours, the European nations, are storekeepers of various sorts; so are we, so is everybody; we are all selling something in this world for a living. Say those neighbors of yours, before they began their general fight, were selling to each other, to you, and to the same outside trade that you reach. If they are so foolish and shortsighted as to drop a good paying business to indulge themselves in a prolonged, hand-to-hand street fight, over something that doesn't concern you, what is the best thing for you to do? Should you leave your customers to go around the corner and idly watch the fight, or should you continue business as usual and supply the needs of former customers of the fighters?

That is this country's position in regard to the European war. Our neighboring tradesmen have all dropped their self-control and their business to engage in a bitter, disgraceful fight, largely over personal matters of vanity and the color of their flags. Two of them met one day on the street and fell into an argument as to who was the strongest man; the argument got hot and soon led to blows; then all the other storekeepers in that vicinity joined in until now a man on the outside cannot see head or tail to the mess. The only thing that is certain is that while this melee is on, outside trade would be at a standstill were it not for the United States, the only storekeeper who has kept his head, although if we had the same conditions around us, we, too, would probably go to war with some one.

One Thing Learned

While this fight is in progress, what are the old customers of our hot-headed neighbors doing? Where are they buying their supplies? A good many of them are not getting them at all; the rest, those who can get up to our counters, are besieging us to sell them. We are responding as far as possible and we are compelled to keep our store open all night to answer the demand. One thing we have learned is that a good many of these new customers want a different line of stuff from what we have been handling, so that it is necessary for us to change our lines considerably, also our terms and ways of selling, if we expect to hold their trade. Will we do this?

Like all neighborhood quarrels, this present one will come to an end. They will fight till some one gets his head broken—some head always does in a street fight—or until all hands are tuckered out and they must give up the luxury of hammering each other, when they will sit down and figure up the cost and go back to making an ordinary living; to pick up their trade where they left it. This fighting may end as suddenly as it began; when it does, this rush of business we are getting is sure to take on a new complexion. How is the United States department store preparing to meet this charge?

New Faces Will Return

In the first place, a lot of these new faces at our counters are bound to return to their old places, simply because they are used to them; anybody would, it's human nature. If your own family grocer, for instance, has a fire in his place and suspends business while rebuilding, do you desert him, or go back to him again when he reopens for business? You go back to him; simply because you have always known him so well and the kind of goods he handles. It will be the same way with the European nations; they will get back a lot of their old customers when the war is over, simply because they have always had them. Of course, there will be a certain part of them we will always retain, once we start business with them. That depends upon how we use them. A large part of them will be people next door to us, South Americans, who realize that in buying of us they can save much time and freight compared to going away down the street to Europe for the same goods. This is simply one of the natural lessons of the war. They are saying to themselves now: "If we have a good store right here next door to us, why trapse way over to the European department store?" Once more, it all depends upon how we treat them.

It has been said of us the only patriotism we know is the patriotism to the sacred dollar; that our flag is merely an enlarged dollar bill fluttering in the wind—the trade wind; and that our national anthem begins, "God save us our 25 per cent on our money," accompaniment: a steam piano.

We haven't time to answer these charges, we're too busy; they can be analyzed after the rush is over, if it will make any one feel better. It's the most natural thing in the world for our unfortunate brothers to call us names and try to make us lose our temper because they've lost theirs. It's human nature for one man not to want to see another taking in money while his own streams through his fingers in a useless outlay.

Here is one matter we must give much serious thought: While our neighbors are fighting, their overhead expense is enormous. When they emerge from the brawl, they will owe so much money they will do anything to get out of debt. When a man is in debt, it is human nature not to be too particular about the job he takes; just so he makes a living and can pay a little on his debt. There is nothing more humbling to a man nor a sharper prod that a big debt hanging over his head. This will be the case of our fellow tradesmen; when they resume business, they are going to mark their goods way down to get back their trade and meet their heavy overhead expense. Here is where we must watch out. We will, for some time to come, get the trade they used to exchange among themselves; at least while they are repairing broken heads and black eyes. But it's the trade going to neutral countries, and, most of all, their trade with ourselves, which will give us the most concern.

Preparedness for Trade

This bitter, destructive fight among them has taught us the need of preparedness. They were beautifully prepared for a fight and they got it. We want to be prepared for trade and we shall get it. The peace to come will bring with it war; a war of goods,

not guns; presented by brains, not military commands.

When a nation stands to lose her trade by lower prices, she puts on a tariff to overcome the handicap.

This is the real question of preparedness before this nation. A swarm of dreadnaughts or a swollen army won't sell more steel nor pay higher wages. What we should be planning and preparing for today is a system to take care of new trade conditions. The chance is before us to become as expert in that as the Europeans are with their war machines.

It is easy to spill patriotic oratory around the country and slop around in printer's ink over the danger of war and military preparedness, but what is of more importance to our daily bread and butter and a little cake is the matter of peace and *new trade conditions.*

The brain work so lavishly begotten and so generously distributed in our legislative halls for the next several years should concern itself more with the construction of trade bulwarks than of military forts. The latter are not so important as they used to be. Trade is more vital to us; we understand that better in this country than we do war. The world's history has always rolled in cycles. Has not the world had its fill of the military cycle, and is it not now approaching the trade cycle? Won't the coming generation be involved more in the balance of trade than in the balance of power?

At any rate, it's human nature to want to trade rather than to fight, so why not do the sensible thing and prepare for trade?

Company Expanding Buildings

The Hartford Auto Parts Co., Hartford, Ct., has given notice to preferred stockholders of a new issue of the common stock of the company amounting to $100,000, in addition to the $70,000 common stock now outstanding. They will be given the first opportunity to subscribe, and if it is not taken up, the public will have a chance to buy this week. The company announces that its new factory in New Britain, Ct., will not be completed until January and that the business will be continued in Hartford until the weather is suitable for moving, which may not be until spring. The plant is operated day and night. New machinery has been ordered, which will be set up in New Britain. For a time, both plants will be operated and when the weather moderates, the machinery from Hartford will be moved to New Britain.

Freight Advance

Is Subject of Hearings—Western Case Not Reopened

Chicago, Nov. 16.—Commissioner Richard Yates of the Illinois public utilities commission is holding hearings in Chicago on the application of 26 Illinois railroads asking for a general freight advance of 5 per cent. This is being opposed by the Chicago Association of Commerce.

Evidence so far brought forward by the railroads is for the purpose of setting forth that large increase has taken place in maintenance, equipment and operation costs since 1908.

The interstate commerce commission has denied the application of western railroads for reopening of the case for advanced freight rates. Along with this denial an order was made for an investigation of rates, rules and practices of western railroads in relation to transportation of live stock, fresh meats and packing house products.

The rate hearing started March 4 and closed June 26. The award gave permission to increase charges on coal, coke and some other commodities, but on others, including packing house products and grain, the advance was refused. The request of roads for advanced rates included commodities which would have yielded about $10,000,000 a year increased revenue and the rates granted will yield only about $1,500,000 per year, which led to the request for a rehearing of the entire case.

The Western Classification Committee will meet Tuesday, Dec. 7, at 1875 Transportation building, Chicago, to consider the proposed ratings on numerous commodities as far as western railroads are interested in them.

Pays Bonus

Reed - Prentice Co., Worcester, Mass., machine tool makers, paid its employes a war bonus of $9,000 on Nov. 1, in addition to wages for work done in October, this being an increase of about $1,000 over September. About 500 men participated in the division, nearly 100 more than last month. Though the company has a machinists' strike on its hands, 900 men having walked out Sept. 20, Vice President and Gentral Manager Albert E. Newton says they are gradually returning to work and he expects normal conditions will be resumed shortly. Some additions to the ranks are from outside the city.

Opened for Business.—F. H. Kappen & Son, Milwaukee, announce that they have opened for business at 93 West Water street. The O. L. Packard Machinery Co. has turned over to them all its merchandise and machinery, and in addition they will act as manufacturers's agents for wood and iron working machinery and other specialties. F. H. Kappen was connected with O. L. Packard as salesman and manager up to 1891, when a corporation was formed and he became its secretary and treasurer.

New Machinery Company

The American Lathe & Press Co., with headquarters in Indianapolis, last week filed articles of incorporation with the secretary of state, the authorized capital stock being $1,500,000. The object of the company as set forth in the incorporation papers is to manufacture instruments, machines and tools. Many of the incorporators are from Richmond, Ind. The directors follow: Fred D. Bethard, Robert J. Breck, Frederick G. White, Lee Bykerman, Arthur Lindner, Clarence C. Talcott and Howard C. Hunt. The men interested in the company have declined to discuss their plans, but it is understood upon good authority that they intend to bid for the purchase of the large plant of the M. Rumely Co., a bankrupt concern, at Richmond. The property of the Rumely company has been in the hands of a receiver for more than a year and Judge A. B. Anderson of federal court of the district of Indiana has authorized the receiver, Finley T. Mount, to sell the property at auction at Laporte, Ind.,

Kentucky Will Have New Law

Manufacturers of machinery and other metal products in Kentucky are much interested in the workmen's compensation situation, as it is practically assured that the legislature which has just been elected and will convene Jan. 1 will enact a measure of that kind. A law providing compensation was created two years ago, but the court of appeals declared it unconstitutional, owing to certain features which were regarded as making acceptance compulsory. An official compensation commission has been at work for some time on a new bill, and as this commission includes representatives of all interests, including the state, manufacturers, labor, coal operators, etc., it is assumed that its recommendations will be adopted without much opposition.

The Scientific Materials Co., Pittsburgh, has purchased a 6-story building at 711 Forbes street, that city.

Founders Discuss Labor Shortage

At National Convention in New York—Increased Efficiency Urged —Secretary Redfield's Policy Condemned

THE nineteenth annual convention of the National Founders' Association held its first session in the Hotel Astor, New York, Wednesday morning of this week, when reports of officers were heard. The convention will continue until noon Thursday.

President's Report

President William H. Barr, in his annual report, spoke of the efforts for the promotion of safety and sanitation which have been made by the committee having this matter in charge and said that if it were possible to secure a fair report from the discredited industrial relations commission, it would include a statement made after a searching examination of all the association records that in the maintenance of its plants, safety, sanitation and employes' welfare generally have received more thorough study and been productive of more comprehensive remedies in the foundry industry than in most other lines of manufacture.

President Barr said that foundry interests, in common with all other manufacturers, are recovering from the depression directly brought about by governmental tariff adjustment, uneconomic and experimental legislation, or inadvised rulings by commissions. As a step toward permanent correction of unjust conditions, business men should demand the co-operation of the government, instead of its antagonism. Attention was called to the awakening interest of bankers who are at last beginning to realize that their own interests are affected if wages are abnormally high, or if production is restricted and buildings or manufactured commodities cost more than a fair market value justifies. The recent report of the National Civic Federation completely destroys the fallacy that labor does not receive its proportionate share of the income from industry. As a matter of fact, labor does receive the lion's share, or 77 per cent of the income.

Mr. Barr expressed fear that the Clayton law, having proved disappointing, an effort will be made to introduce under another name the infamous Pearre bill, defeated by the last congress, which provided that no injunction shall issue except to protect property or a property right. An effort is likely to be made to enact legislation to compel the interstate commerce commission to enforce full crew legislation on all interstate roads. Mr. Barr strongly urged enactment of legislation which would bring labor unions definitely within control of the federal anti-trust law.

The president renewed in a scathing manner the record of Mr. Redfield as secretary of commerce. He referred particularly to his plans to prevent dumping at the conclusion of the war. He said that if a youngster in the primary grade of business life were to adopt the attitude of Secretary Redfield, his career would terminate abruptly.

Mr. Barr urged the members to be prepared for labor troubles during the coming year. "As an association," he said, "we should vigorously oppose this wholesale holdup of business by union agitators in an attempt to force unfair conditions which could not normally be obtained, and which, if gained, can only result in lasting harm to the industry by a manifest inability, later on, to compete successfully for foreign trade."

WILLIAM H. BARR

Mr. Barr especially urged greater attention to machinery appliances and the elimination of hand labor in the production of castings.

The report of Commissioner A. T. McClintock was as follows:

The past year has been one of comparative quiet in foundry labor conditions, due probably to the fact that most of our members have been operating much below normal capacity. Recently, however, there have been increasing signs of unrest, and everywhere we find the molders watching the present eight-hour campaign of the machinists with much interest. At Pittsburgh, the molders' union has made a demand for an eight-hour day, and it is being agitated in a number of other foundry centers.

During the past four months, the molders' union has been making vigorous efforts to increase the membership and promising to obtain shorter hours and increased pay just as soon as sufficient enthusiasm could be aroused. Demands have already been made for increases in the minimum wage rates of from 25 cents to 50 cents per day at a number of points, and more are in contemplation.

In the International Molders' Union, based on income, the average paid membership for the past year has been 28,500, a decrease of 4,000 from the previous year, and 11,500 from two years ago. Due to better trade conditions and vigorous organizing work, they have made a gain of about 2,500 members during the past three months, and to-day stand at approximately 31,000.

The total income to the union's national treasury for the past year has been $375,469, compared to $438,176 for the previous year. Strike benefits last year were $157,762; for previous year, $208,856. Management and other expenses, $182,289, as compared to $204,032 for year before, leaving a balance of receipts over disbursements for year of $35,418. Total assets of national union now, $308,877.

Since our meeting one year ago, the association has been called upon to supply molders and coremakers to six members from whose shops 265 molders were on strike. We have also assisted in supplying molders to three probationary members combatting strikes, involving 194 molders and coremakers. In no case in which the association has been interested has any compromise or settlement been made with the molders' union.

The system of employing molders under long term contracts with the association to assist members combatting strikes, has been continued, and given very general satisfaction. We have found it necessary to increase the number somewhat over last year, and are prepared to make further additions to the list, should occasion require.

Labor Shortage Predicted

It is my own belief that we are to be confronted at the close of the present war with a serious shortage of both common and skilled labor, particularly so should we, after the initial stages of the reconstruction period abroad, find ourselves on a wave of prosperous business. To that end, I urge more than ever, the development and study of production and methods in our foundries. With the exception of certain agricultural shops, and some others where the character of the work permits a higher production development, I believe that the foundries of this country, particularly those engaged in the jobbing business, are not producing more than 50 per cent of the castings which might be made, should the stumbling blocks to

such progress be removed. Eliminating from our discussion union shops where the production is usually away below normal, I emphatically urge the reconstruction of the old style foundry practice by a careful study of molding machines, appliances and modern methods which facilitate greatly increased production. The introduction of piece work and properly planned bonus systems are of distinct help in bringing about this result, and if the bonus proposition includes the foundry foreman, the increased monthly income will cause him to lend himself more readily to what might otherwise be termed "annoying innovations". One concrete example is that of one of our members operating a large and successful business where prior to its foundry strike, under union conditions its production of castings per molder was approximately 800 pounds; whereas as soon as open shop conditions were established and modern appliances put in operation, it increased its production to approximately 1,600 or 1,700 pounds per molder per day.

Barr on David Lloyd-George

"The ridiculous spectacle of David Lloyd-George pleading with the British unions to waive their policy of restriction, begging for the privilege of equipping factories with adequate machinery, and urging that non-members of unions be permitted to work in defense of national honor, foretells without veneer the possible development of the trades union efforts of our own country; unless public opinion is stirred to a realization of the stifling program planned by the American Federation of Labor in an ever widening field of effort."

Greater Efficiency

If some plan could be worked out in our foundries whereby superintendents would have more time available for the study of individual jobs, and the analyzing of machine appliances, they would find that in that particular item of production, the results would be most surprising and gratifying. In the brass foundry of one of our members, where five years ago they were producing less than 200 pounds of castings per molder, the average weight of casting being less than two pounds each, this same firm is today producing approximately 600 pounds of castings per man in exactly the same line of manufacture and corresponding weights. In one case, by the use of cores and chills the molder and helper are producing as many castings as were originally produced by six molders. One coremaker is employed part of the time with the floor machine. In other words, the labor cost on this particular job has been more than cut in half.

It is possible to cite numerous examples of this kind which should have a stimulus to those foundries which have not yet given the subject thoughtful attention. I suggest, too, for the benefit of the trade, that efforts be made to maintain foundries in a clean, orderly, condition and that particular attention be given to ventilation, toilet facilities, lockers, wash-rooms, and any other minor comforts which help to place the trade of molding on a higher mechanical plane.

Requests for consultations with the association's foundry inspector, W. C. Wright, have been continuous throughout the year, and a very large number of our members will bear witness to the helpful advice and suggestions he has given them regarding molding machines and general equipment. I believe this work, which was inaugurated in 1904, has been most beneficial in increasing the efficiency of the foundries of our members.

Secretary's Report

The report of Secretary J. M. Taylor was as follows:

I am pleased to report that 31 firms have been admitted to membership during the past year. In addition, a few applications were received, which could not be accepted, as they did not come up to the standard required by our administrative council.

We have been obliged to drop from our membership roll 26 firms. Of these cancellations, 11 were because the foundries were permanently closed, nine were due to financial difficulties, and six for miscellaneous reasons, such as change in management, reduction of expenses, etc.

While our net gain in members is but five, the gain in financial strength to the Association is considerable. The quarterly assessments of the firms admitted are 140 per cent greater than those of the concerns resigning. The revival in business is reflected in the number of employes now reported. The quarter ending September 30, 1915, showed an increase of 16½ per cent over the same quarter of the previous year.

The circulation of *The Review*, for the past year, has averaged about the same number of copies as for the previous year, almost equally divided between this association and the National Metal Trades Association. This number is not impressive when one considers that the molders' and machinists' unions, whose influence we are directly endeavoring to counteract, send out each month approximately 100,000 copies of their journals. Their journals are also available in every meeting hall, so that the number of their readers is many times the actual subscription list. In addition, hundreds of other unionistic and socialistic publications go into the homes of these same workmen during the course of the year.

The Review is now in its twelfth year. It is beyond the experimental stage. Our correspondence shows that it is read by the workmen and appreciated; it must, therefore, have its influence. It is to be hoped that some plan may eventually be evolved by which *The Review* can be placed in the hands of each one of the employes of our members and its influence correspondingly increased.

Points of President Barr's Address

Said that Walter Drew performed the obsequies of the industrial relations commission with a complete understanding of the inside conditions which lead to the retirement of Chairman Walsh to the suburbs of Kansas City.

Said that business men had given President Wilson unswerving support in his foreign policies.

Said that unexpected assistance to manufacturers is indicated by an awakening interest of many enterprising bankers.

Predicted that as the Clayton law has proved disappointing to the labor leaders, more dangerous legislation will be proposed.

Declared that the seaman's law should be repealed.

Expressed the opinion that the union of five great brotherhoods of railway employes in a nationwide co-operating move is the most gigantic and daring ever attempted by labor unions.

Barr on Redfield

"Secretary Redfield apparently brought with him a violent antagonism to business men and sound business principles, which he manifested within a very short time, by deliberately using his office to prevent the business interests of the country from securing through it any useful administrative act. Instead of being a help to business, Mr. Redfield has become a menace, and, today, we have not only the business men of the country thoroughly disgusted, but, if we are to take the newspaper accounts at their face value, we find the President looking askance at his secretary of commerce."

Slag Hearing Ends

The Pennsylvania public service commission last week completed the hearing of testimony in the so-called slag wasting case in western Pennsylvania. At the close of the session, held in the auditorium of the Pittsburgh chamber of commerce, complainants against proposed slag wasting tariffs were directed to file briefs with the commission within the next 15 days. Railroad carriers involved were told to file their briefs 15 days after those of the plaintiffs' had been submitted.

Some time ago, railroads filed tariffs providing charges ranging from 20 cents to 35 cents a ton for hauling or wasting blast furnace and mill slag in Pennsylvania, Ohio and West Virginia. While these tariffs are in effect, most of the industries affected have declined to meet bills presented by the railroads, pending the investigation.

The Weirton Steel Co., Weirton, W. Va., will increase the capacity of its strip steel mill at an early date.

Business News of Nation's Capital

Much Interest in Bids for Battleships and Armor Plate—Proposed Projectile Plant Indorsed by Admiral Strauss

Washington, Nov. 16.—Unusual interest is attached to the opening of bids tomorrow at the navy department for two battleships and armor plate they will require. The fact that private shipyards are rushed with business has created speculation as to whether prices will be higher and bidders for the vessels will be as numerous as heretofore. The Brooklyn navy yard is expected to submit figures for one vessel. Secretary of the Navy Josephus Daniels is anxious to have congress appropriate money for the enlargement of other navy yards so that the one at Brooklyn will not be the only yard capable of building a battleship. The secretary is said to be desirous of having the ways of the Mare Island, Cal., and Philadelphia yards enlarged so that they can perform this kind of craft construction.

Interest also centers around the figures that will be submitted for armor plate. The higher prices prevailing in the steel market has been recognized by the navy department as being an element which has developed since the outbreak of the European war that has increased the cost of naval construction. This is used as one basis for the argument by Secretary Daniels in favor of having the government erect its own armor plate and projectile plant, and to engage more generally in ship construction and other work involved in the maintenance and upbuilding of the navy. The armor required for each of the two vessels will be approximately the same as that for the battleships CALIFORNIA, MISSISSIPPI and IDAHO, for which awards were made on Oct. 27 of last year. Each of these vessels required 8,128 tons, divided as follows, with the prices at which the awards were made:

Class.	Tons.	Price.
A-1	7,374	$435
A-2	401	486
B	290	466
C (steel)	63	376

The Midvale Steel Co. was awarded one vessel and the other two went to the Bethlehem Steel Co. Tomorrow will mark the first time that bids have been opened for armor plate since the Midvale Steel Co. was reorganized and incorporated under the name of the Midvale Steel & Ordnance Co.

In his annual report for the fiscal year 1915, made public recently, Rear Admiral J. Strauss, chief of the bureau of ordnance of the navy department, said that of the 24,500 tons of armor awarded for the three battleships named, about 4,330 tons had been delivered. It is estimated that the work on the armor has progressed to about 50 per cent of completion, and it is probable, Admiral Strauss says, that all deliveries will be completed by the date on which the vessel for which the armor is intended is launched. Admiral Strauss is silent with regard to recommending that the government erect its own armor plate plant. He passes the subject by after referring to the investigation made with this purpose in view by a congressional committee and by himself last year, and stating that the amendment for an appropriation for the building of a government-owned armor plate plant was stricken from the naval bill in conference.

He does, however, recommend that a projectile plant should be established by the government, justifying such a recommendation "in view of our own success and the fact that other manufacturers have succeeded in producing the required shell, and their evident reluctance to undertake their manufacture". Great difficulty, he says, has been experienced in obtaining projectiles in accordance with the new specifications for armor-piercing projectiles, which were first put into practice in 1913. Four manufacturers are now making armor-piercing shells for the navy department, three are making common projectiles, "and a large number of concerns have competed toward obtaining contracts for target projectiles, in consequence of which the source of supply for the last named material has widened, and two firms in the south are now engaged in its manufacture".

Admiral Strauss indicates the increase in the cost of armor-piercing projectiles of the 14-inch caliber since January, 1914. The contract of Jan. 28, 1914, was for $320 and that of March 27, 1915, was for $415.

Some of the increased price, it is stated, may be attributed to the increased severity of specifications, to the increased demand by reason of the European war and absence of foreign competition. For some months, says Admiral Strauss, the bureau has been experimenting with the manufacture of armor-piercing projectiles at the naval gun factory (Washington), and has produced satisfactory ones of 8-inch caliber. The manufacturer of experimental shell of larger caliber is being undertaken. The specifications for armor-piercing projectiles are undoubtedly severe, says the report, but they can be met.

Moving Pictures

Washington, Nov. 16. — The publicity bureau of the national rivers and harbors congress issued a statement today announcing that one of the most interesting special features of the twelfth annual convention of the congress, to be held in this city on Dec. 8, 9 and 10, will be the exhibition, accompanied by an explanatory lecture, of a series of moving pictures showing every step in the process of iron and steel manufacture. The statement goes on to recount the ore tonnage that has been transported on the Great Lakes and the vessels carrying the greatest cargoes. Special emphasis, it is stated, will be given at the convention to the fact that the greatest possible prosperity for the country can be attained and maintained only through the equal development and the harmonious co-operation of highways, railways and waterways.

Export Regulations

Washington, Nov. 16.—Interior steel producers were represented at the hearing held here last Thursday before officials of the treasury department and the department of commerce when protests were made against new export regulations prepared by the departments, to be operative on Jan. 1. The officials denoted plainly that they were open to suggestions, and, having received them, indicated they would make certain revisions in the regulations which the shippers desired. On the other hand, the officials cleared away numerous points in connection with the regulations which convinced the shippers that some of the features were not as stringent and burdensome as had been believed.

Claiming that the declaration of a steamship company with regard to an outbound cargo is based entirely on guesswork, the officials said that they had formulated the new regula-

tions to compel the original shipper to file a declaration giving the required data with the initial rail line receiving the shipment and to hold the railroad responsible for the filing of these declarations with the collector of customs under the export bond required by the government. Present among others at the hearing were C. L. Lingo, of the Inland Steel Co., Chicago; John M. Glenn, of the Illinois Manufacturers' Association, who represented producers of that state affiliated with the association; railroad men and others.

Far in Future

Washington, Nov. 16.—That decision in the Steel Corporation dissolution case by the Supreme Court is a long way off was made evident last week when Henry E. Colton, special attorney for the department of justice, filed with the clerk of that tribunal an order granted by the United States district court of New Jersey extending until March 15, 1916, the date for filing by the department of condensed volumes of the evidence involved in the case. Mr. Colton explained that the department had asked the lower court for the order and that counsel for the defense was willing that the order should be granted. The extremely big task of reducing the evidence, constituting 57 volumes, to three or four volumes, was recognized as requiring extended time for filing of the condensed volumes. After it is filed, the department will follow this action with the filing of its brief, after which oral arguments will be heard. It is now believed that the arguments cannot be heard until after the court convenes in October of next year, indicating that a decision will not be reached until the fore part of 1917.

To Raise More Revenue

Washington, Nov. 16.—Among the methods which it has been suggested the federal administration will devise for raising revenue at the forthcoming session of congress to finance its national defense program is the proposal to place a tax upon the war munition industry of this country. Secretary of the Treasury William G. McAdoo has asked the bureau of internal revenue to submit to him a report on the extent of the industry, and it is known that the bureau has already prepared a confidential report on the operation of the war revenue tax, which will be revised and continued in effect, it is believed. This information is held in readiness in the event congress asks for it. This report is understood to relate to the extent of the war munition industry, as well as the extent of other industries, from which it might be thought advisable to raise revenue through taxes.

Published reports that the administration had considered the plan of placing a direct tax on munitions are unfounded. As this would in effect be an export tax, it would be unconstitutional. With a tax placed on munitions made in the United States it would, in accordance with the drawback feature of the tariff act, be necessary to refund such taxes when the munitions are exported. It is obvious, then, that only those munitions which are consumed in the United States would carry the tax. The United States government itself, being the largest consumer of such munitions, would be assessing a tax against itself.

Some consideration has been given, however, to the imposition of a license tax on the manufacture of munitions, similar to the war tax now applying on brokers, manufacturers of tobacco, and other businesses.

Special Agent Has Busy Days

Washington, Nov. 16.—Great interest has been shown by American manufacturers in the action of the bureau of foreign and domestic commerce, department of commerce, in sending out an export trade adviser on a tour of cities in various parts of the country, and the resulting large demands upon the time of this adviser, Special Agent Stanley H. Rose, have brought very busy days to him in every place that he has visited.

Mr. Rose was in Ohio last week, and his three days' schedule at Springfield was made up of conferences with business men and representatives of manufacturing plants, held at the rooms of the Commercial Club, and addresses before several organizations.

On the first day of his visit to Springfield, Mr. Rose held conferences beginning at 10:00 a. m., with representatives of power machinery manufacturers, at 1:30 p. m., with makers of machine tools and specialties, and at 3:30 with makers of miscellaneous lines of goods. At 12:15 p. m., he addressed the Rotary Club on "Ethics of Foreign Trade", and at 7:30 in the evening spoke before the Commercial Club on "Government Aid in Increasing Springfield's Foreign Trade", illustrating the latter address with stereopticon slides emphasizing the superiority of American-made goods in foreign countries.

On the second day, the conference hours with manufacturers were repeated, morning and afternoon, with special attention given to agricultural implements, automobile accessories and specialties, and miscellaneous goods.

The conferences of the third day, held morning and afternoon, were on grinding and separating machinery, and household necessities, concluding a period during which the foreign markets for the products of Ohio industrial plants were very widely discussed.

From Springfield Mr. Rose went to Columbus, and will proceed to Lincoln, and Omaha, Neb., Des Moines, Davenport and Burlington, Iowa, St. Louis, Mo., Louisville, Ky., Cincinnati, and Marietta, Ohio, Johnstown, and Reading, Pa., and the New York office of the bureau, closing that portion of his tour on Dec. 24.

Favors Old Rate

In an article appearing in *The Iron Trade Review* on Nov. 4, it was incorrectly stated that the Vulcan Iron Works Co., in a petition filed with the interstate commerce commission, opposed the restoration of the 45-cent rate on iron and steel articles from Mississippi river crossings to Denver. The company advises that, on the contrary, it has been assisting in every possible way the efforts of the Hardesty Mfg. Co., and is in favor of having the 45-cent rate re-established to take the place of the present rate of 60 cents.

Will Resume Jan. 1

The Alton Steel Hoop Co., Alton, Ill., successor to the Alton Steel Co., controlled by the Fownes interest, Pittsburgh, will resume operations about Jan. 1. A number of important improvements are being made at the plant. A 150-ton striping crane and a 5-ton soaking pit crane are being installed by the Alliance Machine Co., Alliance, O., and Mackintosh, Hemphill & Co., Pittsburgh, are furnishing a hot saw to cut up to 12 x 12-inch hot billets. Additional equipment is being installed in the power plant and a number of changes are being made to the 18-inch mill. A 50,000-gallon tank is being erected by the Pittsburgh, Des Moines Steel Co., Pittsburgh.

Orders Booked.—The Thos. Carlin's Sons Co., Pittsburgh, has taken the following orders: Bryden Horse Shoe Co., two No. 38 belt-driven shears; Standard Chemical Co., one 6-foot grinding pan; Jones & Laughlin Steel Co., two 8-foot self-discharging grinding pans; Western Iron & Pipe Co., of Tulsa, Okla., one No. 5 shear; United States Engineer's office, two 10 x 12 link motion engines, for operating gates lock No. 1 Ohio river, valve operating gate machinery for lock No. 6, Monongahela river.

Iron and Money: Fact and Comment

Speculative Craze Disappears and Stock Market Moves More Smoothly—Many Indications of Prosperity

INDICATIONS of the wonderful prosperity of the country are becoming very impressive. Reports of the clearing houses show that the clearings for October were 72.4 per cent greater than for October, 1914, and 30 per cent more than those for October, 1913. Reports of additions to steel plants, of tremendous crops, of gains in building operations, and statistics from many lines of industry show how the country is going forward. The stock market is, however, not so excited as it was some time ago and is proceeding in an orderly manner, particularly in stocks closely connected with the iron and steel business. Gains for the week were moderate and declines were few.

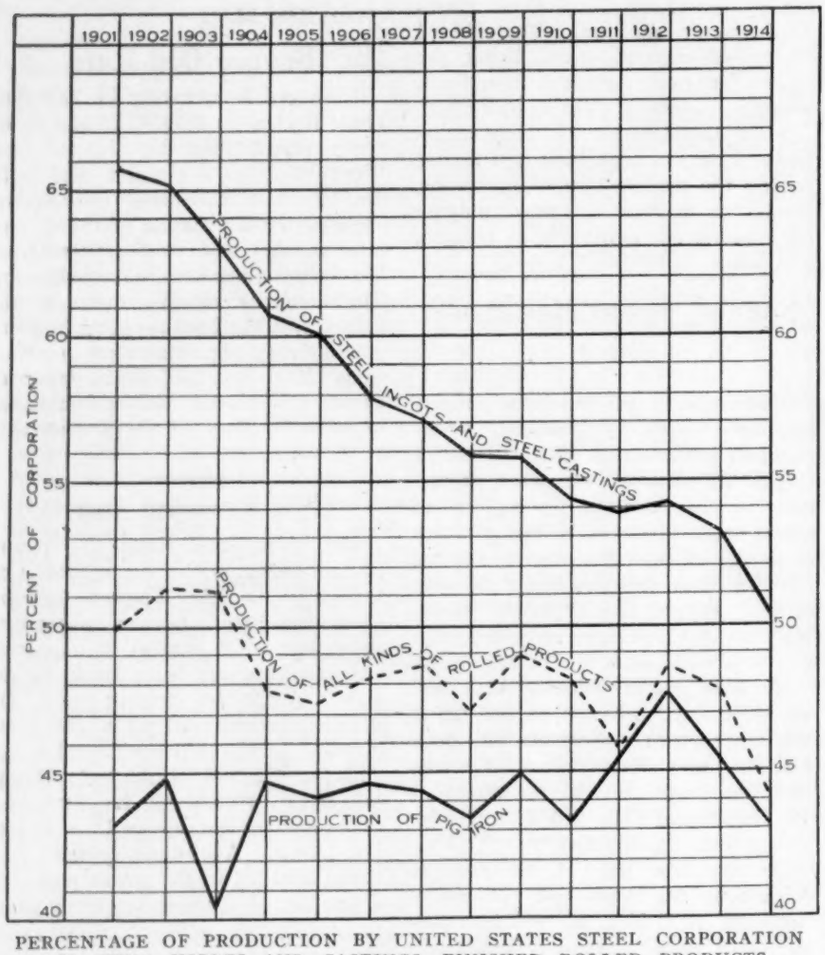
The market opened with some irregularity Monday and after a period of upward tendency, developed weakness at the close. There seemed to be a good deal of professional manipulation in the market.

Tuesday was a rather dull day and Bethlehem Steel distinguished itself by not appearing at all, as not a single sale in this stock was recorded. The members of the French industrial and commercial commission to arrange for the purchase of a vast quantity of structural steel and machinery to be delivered after the war's conclusion arrived in New York.

Wednesday the Steel Corporation's report of large increase in unfilled orders had a stimulating effect and the market was active and strong at the close. Railroad shares were strong throughout the session.

There was a general recovery Thursday, except in rail stocks. Automobile shares were particularly strong. General Motors advanced 25 points, to 400, and Willys-Overland made a gain of 23 points. Chairman Gary's announcement of new plant additions at Gary, Youngstown and Pittsburgh had a good effect Friday. Motor and war stocks continued to reflect considerable strength.

The week was ended Saturday with a quiet but strong market. There was evidence of the speculative fever having subsided.



PERCENTAGE OF PRODUCTION BY UNITED STATES STEEL CORPORATION OF STEEL INGOTS AND CASTINGS, FINISHED ROLLED PRODUCTS AND PIG IRON, 1901-1914

Quotations at the close of business Nov. 13 and changes in the leading stocks identified with the iron and steel industry for the week are shown in the following table:

	Close Nov. 13.	Net chg.
American Can	62⅜	+3⅞
American Can, prfd.	108	+1½
Amer. Car & Fdy. Co.	83	+1¾
Amer. Car & Fdy. Co., prfd.	117⅛	+ ⅜
American Locomotive	67½	+1⅜
American Locomotive, prfd.	98½	+ ½
American Steel Foundries	64½	—3
Baldwin Locomotive	122	+1½
Baldwin Locomotive, prfd.	109	.....
Bethlehem Steel	444	+1⅛
Bethlehem Steel, prfd.	162½	—2½
Colorado Fuel & Iron	54½	+ ½
Continental Can	92	+ ½
Crucible Steel	77¼	+3
Crucible Steel, prfd.	107⅛	+1⅛
General Electric	177½	— ⅜
International Harv. of N. J.	110	—1
Inter. Harv. Corp.	70	.....
Lackawanna Steel	31⅞	+7⅜
Nat'l Enamel. & Stamp. Co.	31¾	+1¾
Nat'l En. & Stmp. Co., prfd.	92½	+ ½
Pressed Steel Car	67	— ⅞
Pressed Steel Car, prfd.	104½	+ ⅛
Pullman Palace Car	165⅞	—1⅛
Republic Iron & Steel	53	+2⅛
Republic Iron & Steel, prfd.	106	+ ¾
U. S. Cast Iron Pipe & Fdy.	28	+ ½
U. S. C. I. P. & Fdy., prfd.	54½	— ¼
United States Steel	87⅝	+ ⅜
United States Steel, prfd.	116½	+1
Westinghouse Mfg.	69¾	+ ¾

The following table shows changes in maximum quotations of stocks not listed on the New York stock exchange:

	High Nov. 12.	High Nov. 5.
American Radiator	....	360
American Ship Building	36	43
Cambria Steel	70⅛	67⅝
Chicago Pneumatic Tool	83	87⅜
Inland Steel	....	....
LaBelle Iron Works	59½	59½
Lake Superior Corpn.	10⅜	11¼
Pennsylvania Steel	70	85
Stewart-Warner Speed. Co.	83¼	75⅝
Warwick Iron & Steel Co.	10½	10¾
Westinghouse Air Brake	141½	142
Westingh'se Elec. & Mfg. Co.	70¾	72½

Steel Corporation

The annual statistical report of the American Iron and Steel Institute, compiled by the bureau of statistics, of which William G. Gray is chief, has just been issued. Some changes in the arrangement of the report and the table of contents which facilitate the use of the volume are the work of Howard H.

Cook, assistant secretary of the institute. Nearly all of the important statistics have been published in bulletins and in *The Iron Trade Review* during the past year.

The table showing the production of leading iron and steel products by the United States Steel Corporation and other companies is brought up to date and shows that in pig iron, steel ingots and castings and in the total of finished rolled products the percentage has declined since 1901 as follows: Pig iron, from 43.2 to 43.1; ingots and castings, from 65.7 to 50.3; rolled finished products, from 50.1 to 44.1.

Keen Interest is Expressed

In Proposed Change of Rate on Steel Products to Pacific Coast—Many Companies Represented at Hearing

Washington, Nov. 16.—Engaging the deep interest of steel producers, fabricators and dealers throughout the country, the hearing held last Friday and Saturday before Examiner Henry Thurtell of the interstate commerce commission on the application to extend the all-rail rate of 55c per 100 pounds on steel to Pacific coast terminals from Chicago back to Pittsburgh was attended by approximately 100 people. The great majority of them included representatives of steel interests, while the remainder appeared on behalf of the railroads asking authority to establish the rate, and the coastwise steamship companies opposed to granting of such authority. Mr. Thurtell presided as chairman of the fourth section board of the commission, this board always passing originally on applications such as the one under consideration, and which seeks the right to put the 55c rate into effect without regard to rates to intermediate points; or, without observing the long-and-short-haul provision of the act to regulate commerce.

It has been extremely seldom that the commission had before it a proceeding of such importance to the steel trade. The thoroughness with which witnesses and attorneys brought out the many phases of the case, the conflicting views expressed by steel interests in the different sections of the United States, and by the railroad and steamship lines signified the value placed upon the steel trade coming from the Pacific coast.

Fabricators intermediate between Pittsburgh and Chicago insisted that if the 55c rate is extended back as proposed, the omission should compel the railroads to continue the privilege of fabricating in transit, which carries a penalty of 1½c per 100 pounds; with this privilege continued, as it is thought it would be, this class of fabricators indicated they would not be opposed to the establishing of the rate, but if this privilege were denied them, they said they would be opposed to the 55c rate being extended, because they claimed it would result in giving Pittsburgh fabricators an added advantage. C. L. Lingo, general traffic manager for the Inland Steel Co., voiced views for his company which appeared to represent those of all Chicago makers. Opposing the extension of the rate, he took the position that Chicago is entitled to a lower all-rail rate than Pittsburgh because the latter is nearer to the Atlantic seaboard and has the benefit of a combination of the rail rate to Atlantic ports plus the water rate to Pacific terminals. Charles R. McCarey, traffic manager for Milliken Bros., Inc., Staten Island, N. Y., opposed the reduced rate unless the Pittsburgh-New York proportional of 16.9c is lowered. It would be of no benefit to eastern fabricators, he said, to have the rate to Pittsburgh or the Atlantic seaboard lowered without the proportional being cut. Raw material, he pointed out, is bought by the eastern fabricators from Pittsburgh, and sales are made on the Pittsburgh delivery price. Moreover, he said Pittsburgh's assembling cost is the lowest in the country. Eastern steel makers opposed the rate until it were extended back to the Atlantic seaboard. They insisted that the railroads had promised to make such an extension, just as the Pittsburgh interests claimed a similar promise had been given to them. The eastern makers do not want the rate granted to Pittsburgh first, but desire that the complete extension be made at the same time. Pittsburgh interests pointed out that in the past they were on a rate parity with Chicago and that that was necessary to make the adjustment equitable. It was further explained by them that conditions in the steel industry have changed and Pittsburgh is no longer the universal basing point, as in the past, but has to go out into the markets and in order to compete successfully with such districts as Chicago, other Great Lakes ports, and Birmingham, Ala., must meet prices based upon those places, and not on Pittsburgh. The Luckenbach Steamship Co., and the American-Hawaiian Steamship Co., represented by Attorney Frank Lyon, this city, indicated that they were entitled to continue getting steel tonnage from Pittsburgh district when the Panama canal is again opened, and that the proposed rail rate is abnormally low.

N. L. Moon, traffic manager for the Alan Wood Iron & Steel Co., appeared on behalf of eastern steel makers, among others being the Bethlehem Steel Co., the Midvale Steel & Ordnance Co., the Pennsylvania Steel Co., and the Maryland Steel Co. Objection was made by Mr. Moon to the extension of the 55c rate to Pittsburgh prior to similar action with regard to the Atlantic seaboard. C. H. Donnelly, attorney for the Northern Pacific, who, with R. H. Countiss, chairman of the transcontinental freight bureau, represented the railroads, said he thought the 55c rate would be given the eastern steel interests. The only thing remaining to bring this about, he explained, so far as the railroads are concerned, is the matter of rate divisions among the trunk lines. Failure to give the Atlantic seaboard the 55c rate, said Mr. Moon, would place interests in that section at a disadvantage of 20c per 100 pounds, and would prevent them from competing with Pittsburgh.

"We would be in a precarious position," he explained, "with such an all-rail barrier against us and the American-Hawaiian line surrounded by temptation to go and make a fortune by entering the foreign trade. Even with the same rail rate Pittsburgh has an advantage over eastern Pennsylvania because of Pittsburgh's lower assembling costs. Pittsburgh is able to reach the Atlantic seaboard on terms of equality with us, for the same region. She markets billets within ten miles of our mills."

H. C. Crawford, general traffic manager for the Cambria Steel Co., with works at Johnstown, Pa., gave testimony favoring the 55c rate for Pittsburgh and indicated that his company was willing to take chances on Johnstown being granted that rate.

A. L. Roney, general traffic manager of the American Rolling Co., Middletown, O., who also represented steel interests in Portsmouth, and Cincinnati, contended for the establishment of the 55c rate for Pittsburgh. He pointed out that the interests he appeared for were in a unique position, because as conditions now prevail, there is a differential of 8.9c per 100 pounds in the rate to Pacific terminals in favor of Pittsburgh on canal traffic, while Chicago is favored to the extent of 12.6c per 100 pounds with its 55c rate against the rate of 67.6c applying all rail from the points he represented. He asked that the southern Ohio interests be placed on the same basis as Chicago and Pittsburgh and be granted the benefit of the 55c all-rail rate.

Heavy Buying Enlivens Tool Market

General Railway Signal Co. and General Electric Co. Buy Extensively —Crane Builders Active—Rolling Mills Enter Market

THE machine tool market again is characterized by a large amount of business in equipment for manufacturing war munitions. The largest purchaser during the week was the General Railway Signal Co., Rochester, N. Y., which purchased equipment involving an outlay of probably more than $200,000. This concern booked a war munitions contract through J. P. Morgan & Co., and in addition to devoting its present facilities to the making of shells, will erect an additional plant at once. The principal output of the company, according to an announcement by W. W. Salmon, president, will be 9-inch howitzers. Other large purchasers during the week were the General Electric Co., which bought a great deal of additional shell-making equipment for its Lynn, Mass., plant, the International Steam Pump Co. and the American Brake Shoe & Foundry Co., the latter companies also purchasing shell-making equipment. Practically all of the above business, on account of the sold-up condition of the market, was placed for delivery three to four months ahead. In addition, there was some good-sized purchasing by the E. W. Bliss Co., the Baldwin Locomotive Works, the Remington interests and other munition makers, practically all of whom have been consistent buyers since their heavy initial purchases of six months to a year ago. It develops that a large portion of the heavy business placed by the Midvale Steel & Ordnance Co., reported in last week's issue of *The Iron Trade Review,* consisted of lathes of the sizes suitable for shell-making. An event of great interest to machine tool makers was the heavy loss occasioned by the fire in the large No. 4 machine shop of the Bethlehem Steel Co., and it is expected the company will come into the market without delay for considerable equipment to replace that which was damaged.

In addition to the big domestic demand from munition makers, the export demand is rather heavy, although by no means as active as in past months. Some good-sized orders now are being entered from Italy and Russia. Equipment buying is not materializing as rapidly as was indicated by the state of the market a few weeks ago. Few tools have been purchased here and there by different railroads, but none of the purchases was of any great importance and the demand from these interests does not show a sustained character. Purely domestic demand for machine tools maintains the improvement of previous weeks, but no spectacular transactions are reported.

Included in this week's crane business is the purchase of three 60-ton Niles cranes for installation at a ship yard in France. The Bethlehem Steel Co. is in the market for a large number of additional cranes, including one having a capacity of 150 tons. The Bethlehem Foundry & Machine Co. has ordered three Pawling & Harnischfeger cranes, having capacities of 5, 10 and 25 tons. The Birdsboro Steel Foundry & Machine Co. bought two Niles cranes, 25 and 10 tons, and the Solvay Process Co. bought one 15-ton Shaw crane. The American Smelting & Refining Co. is in the market for two 10-ton cranes for installation at Perth Amboy, N. J. The New York Central railroad is in the market for a 15-ton locomotive crane and the Erie railroad, Kent, O., for a locomotive crane to handle a 2-cubic yard bucket. The Maryland Steel Co. is in the market for three 10-ton cranes for its marine department.

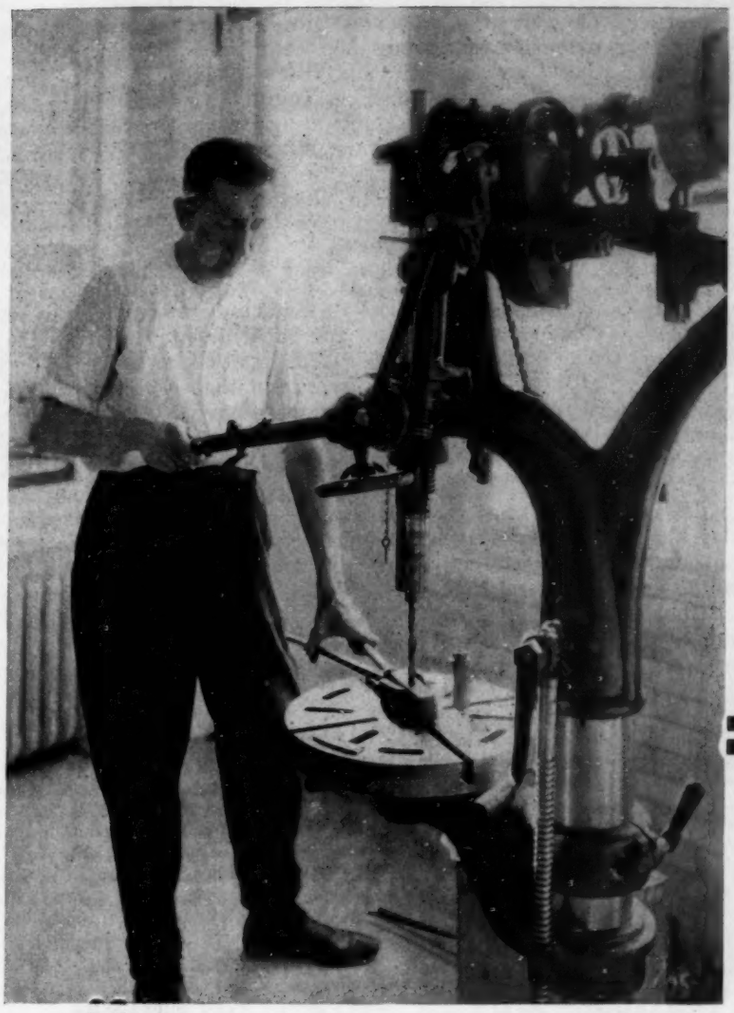
Among eastern concerns who are expanding their capacity are the American Metal Bed Co., Newark, N. J.; Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; Brown, Lipe & Chapin Co., Syracuse, N. Y.; E. W. Bliss Co., Brooklyn; American Engineering Co., Philadelphia; Smith Foundry, Salem, Mass.; Sleeper & Hartley, Worcester, Mass.; Sloane Mfg. Co., Bound Brook, N. J., which is moving to a larger plant at Plainfield; American Gas Accumulator Co., Philadelphia, which will erect a large plant at Elizabeth, N. J.; Connecticut Telephone & Electric Co., Meriden, Ct.; Maxim Munition Co., New Haven, Ct.; Beckton Chemical Co., Newark, N. J.; America-La France Co., Elmira, N. Y.; Metals Plating Co., New York, which will erect a new plant at Elizabeth, N. J., and the Durham Duplex Razor Co., Jersey City, N. J.

Chicago Market Slack

Demand for machine tools in Chicago is strong, but without any striking features. Dealers find difficulty in obtaining tools to meet requirements, and recent labor difficulties have delayed shipments. Second-hand machines in even small lots are not available. Most of the inquiries are due to direct or indirect war orders, but of late the domestic demand has considerably increased. Much interest has been manifested in the formation of the American Lathe & Press Co., incorporated in Indiana with a capital stock of $1,500,000. It is rumored that the company was formed with the intention of purchasing the Richmond, Ind., plant of the Rumely Co., which is to be sold at public auction by the federal court at Laporte, Ind., Dec. 9.

Pittsburgh Crane Market Active

Buying of equipment for plant extensions is the principal feature of the machine tool market at Pittsburgh. The American Sheet & Tin Plate Co. is receiving bids for 10 electric traveling cranes and rolling mill equipment for the new addition at Gary, Ind. The Alton Steel Hoop Co., Alton, Ill., has closed for a 150-ton stripping and a 5-ton soaking pit crane with the Alliance Machine Co., Alliance, O., and has ordered a hot saw from Mackintosh, Hemphill & Co., Pittsburgh, to cut up to 12 x 12-inch hot billets. The 18-inch mill will be rebuilt, the run-out tables of the hoop mills remodeled and a number of improvements made. The Shelby Steel Tube Co., Ellwood City, Pa., which is doubling the capacity of its seamless tube mill, has closed for five electric traveling Alliance cranes and the Mesta Machine Co. has ordered a 50-ton Alliance crane, having a span of 80 feet. The Aluminum Co. of America has bought two 6-ton cranes for its plant at Maryville, Ala., and one 6-ton crane for the works at Massena, N. Y., from the Alliance company. The Pittsburgh Steel Co., which is increasing the open hearth steel capacity of its plant at Monessen, Pa., has bought two electric



The Laboratory backs up the Furnace Operator

AGATHON STEELS

Drilling Test Bar in Sample Room of Laboratory

All Chance is Eliminated

In the plant of The Central Steel Company, a simple inspection of the fracture of a freshly broken test bar is not sufficient proof of **quality.**

Each bar is rushed to the laboratory and almost before it is cold several samples are drilled out and subjected to minute chemical analysis.

Thus we protect the reputation of our trade-mark, and insure our patrons steel of the very highest quality.

AGATHON STEELS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Steel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steel
"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" Silico-Manganese
"AGATHON" High Carbon

THE CENTRAL STEEL COMPANY

MASSILLON, OHIO

Detroit Office: 326-27-28 Ford Bldg., F. Walter Guibert, District Representative
Cleveland Office: Hickox Bldg. The Hamill-Hickox Co., District Representative

jib spout cranes. Numerous inquiries for electric traveling cranes are pending. Most crane builders are unable to promise delivery in less than 12 or 15 weeks, unless purchasers are able to obtain the necessary structural material in the open market.

Cleveland Builders Optimistic

The machine tool market in Cleveland is quiet. The rush of orders has subsided, and while some contracts are being tendered, builders are content to accept the temporary lull and settle into a period of steady production. Enough orders are on the books to keep the majority of tool builders busy for months. Deliveries are quoted from 10 to 15 months on some machines. A decided attitude of optimism is shown by dealers and builders regarding existing conditions. While admitting that the recent tremendous spurt is due largely to the hostilities abroad, the local domestic market, exclusive of all direct or indirect war orders, is much stronger. One machine tool builder in Cleveland, whose plant is working 24 hours a day, has refused one contract after another, each with a handsome bonus attached, not because of any humanitarian tendencies, but because the purely domestic demand affords him more business than he can accept. The Cleveland Punch & Shear Works Co. has been awarded a contract by the Fore River Ship Building Corporation for punches, shears and presses for the extensive fabricating shop extensions at Quincy, Mass. The Cleveland company also has taken an order from the Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, for fabricating machinery. The two contracts will total about 30 machines. The Cleveland Punch & Shear Works Co. is extending its 80 x 150-foot machine shop one story to accommodate present and prospective orders.

Cincinnati Strike Nearing End

Striking machinists in Cincinnati are gradually returning to work, and the backbone of the strike appears to have been broken. Deliveries at the plants affected by the strike have been slightly delayed. The Bethlehem Steel Co., which suffered a disastrous fire last week, has asked all Cincinnati machine tool makers to state their earliest deliveries on lathes, radial drills, milling machines and special equipment. It is estimated that over $1,000,000 worth of machinery has been sold to the Bethlehem Steel Co. in the past year by Cincinnati firms, among which are the R. K. Le Blond Machine Tool Co., and the Lodge & Shipley Machine Tool Co., whose combined sales alone will total about $350,000. The Motsinger Device Co., La Fayette, Ind., on its bid of $2,500,000, has been awarded a contract for 1,000,000 time fuses.

EASTERN STATES

BRISTOL, CT.—The Bristol Brass Co. has started work on new rolling mill and casting shop buildings, 30 x 60 and 30 x 180 feet.

HARTFORD, CT.—Owing to the fact that the new building being erected in New Britain for the Hartford Auto Parts Co. will not be completed until January, the concern will conduct its business in the old Cheney mill on Market street, and expects to remain until next May. Operations will be commenced in the new plant as soon as possible, so that the company for a time will keep both plants running.

MERIDEN, CT.—The Connecticut Telephone & Electric Co. has awarded the contract for a 5-story, 35 x 40-foot addition to its present 5-story plant.

NEW HAVEN, CT.—The Maxim Munition Co., which is operating the plant of the Fuller Mfg. Co., has plans under way, according to announcement by Vice President Edw. R. Beckert, for new buildings.

WATERBURY, CT.—The Waterbury Tool Co. has let the contract for two 1 and 2-story machine shop additions, 30 x 100 and 100 x 200 feet.

ALBANY, N. Y.—The Standard Shipbuilding Corporation has been incorporated to engage in ship building, manufacture of aeroplanes, submarines and the building of hotels and theatres; $3,000,000 capital stock; by Edward A. Clark, William H. Coolidge, Boston, Mass.; Edward A. Faust, Herman C. Syliefel, St. Louis, Mo.; Henry W. Baird, Freeport, and H. A. Ayers, Irvington-on-Hudson, N. Y.

BUFFALO, N. Y.—The Sterling Engine Co. has let the contract for a 1-story addition.

ELMIRA, N. Y.—America-La France Co., manufacturer of automobile fire engines has let the contract for a 2-story, 120 x 130-foot paint and varnish shop.

JAMESTOWN, N. Y.—The Watson Mfg. Co. has begun work on a 2-story, 60 x 120-foot factory building.

JAMESTOWN, N. Y.—The Ellison Brass Mfg. Co., at Falconer, near Jamestown, plans the erection of a brass foundry, 50 x 100 feet. This structure will be built of concrete.

LONG ISLAND CITY, L. I.—Cassidy Mfg. Co. has leased space in a building at the corner of Sunswick street and Wilber avenue for manufacturing lighting fixtures.

LONG ISLAND CITY, L. I.—The Interocean Transport Co. has purchased the plant of the Aztec Asphalt Co. here, which has a frontage of 125 feet on the Division street canal.

NEW YORK.—The New York Central railroad is in the market for a 15-ton locomotive crane.

NEW YORK.—The American Smelting & Refining Co. is in the market for two 10-ton cranes to be installed at Perth Amboy, N. J.

ROCHESTER, N. Y.—The General Railway Signal Co. has awarded the John W. Cowper Co., Buffalo, a contract for the erection of a 1-story, 120 x 400-foot brick, steel and concrete plant.

ROME, N. Y.—The Rome Wire Co. will increase its capital stock from $600,000 to $1,500,000. Work is now started on the 100 x 300-foot, 1-story fireproof building that will be used for the manufacture of copper rods.

SCHENECTADY, N. Y.—Keith O. Guthrie, engineering contractor, has been awarded a contract for the construction of a concrete and steel bridge over the Hudson river at Port Edward. This structure will be of the 3-span type.

TONAWANDA, N. Y. — The Plastergon Wall Board Co. has let the contract for two 1-story factory buildings, 60 x 273 and 40 x 140 feet.

DANVILLE, PA.—The Danville Structural Tubing Co. has been incorporated; $600,000 capital stock; by E. F. Price, S. C. Rebman, S. L. Marks, J. N. Pursel, Danville, Pa., and C. S. Wagner, Bethlehem, Pa.

SCRANTON, PA.—J. R. Fleming & Son Co. has been incorporated to make castings; $50,000 capital stock; by J. R. Fleming, J. T. Fleming, S. A. Fleming.

PHILADELPHIA.—J. C. Moyer & Co. have been awarded a contract by the United States government for 16 iron and steel retorts to be used in the manufacture of nitric acid at the naval proving grounds at Indian Head, Md.

SPARROWS POINT, MD.—The marine department of the Maryland Steel Co. is in the market for three 10-ton cranes.

CENTRAL STATES

BRAZIL, IND.—The city council has leased two plots of ground to the Wood Turret Machine Co. for a term of years and this company will erect an addition to its plant.

EVANSVILLE, IND.—The plant of the International Steel & Iron Co. was recently damaged by $25,000 fire. The planing mill was also damaged.

FORT WAYNE, IND.—The Dudlo Mfg. Co. manufacturer of wire enameling, will build a foundry at Fort Wayne costing $5,000.

INDIANAPOLIS.—The Woolley Mfg. Co., of Anderson, Ind., was incorporated with a capital stock of $10,000. The company will manufacture and repair machinery. The directors are William J. Woolley, Frank Fath, John C. Stephenson, Foust Childers and Charles C. Childers.

KOKOMO, IND.—The Haynes Automobile Co. is to build a plant at Kokomo, costing $250,000.

MUNCIE, IND.—The plant of the Gill Clay Pot Co. was damaged by $50,000 fire. It has been announced that the plant will be rebuilt.

NEW ALBANY, IND.—The Indiana Veneer & Panel Co. will build an addition that will double the capacity of the plant. Electric motors and woodworking machinery will be needed.

NEW ALBANY, IND.—J. C. Hagerty, general freight agent of the Baltimore & Ohio Southwestern railroad announced that work will be started shortly on a freight depot to cost about $10,000.

ROCKPORT, IND.—The Rockport Water Works Co. will extend its transmission line 15 miles to Grandview.

SHOALS, IND.—Public utilities commission has authorized the Shoals Utilities Co. to issue $27,500 in bonds for improvements to the water works and electric light plant.

VALPARAISO, IND.—If experiments in progress here prove successful, the McGill Metal Co. of this city will manufacture 2,000,000 timers for use on Russian shells for which the General Electric Co. has the contract. Representatives of eastern companies have been favorably impressed with the McGill metal, a

process of hardened bronze used instead of brass. Molds now are being cast for the timers.

MILWAUKEE.—The city plans to build a brick and steel animal house in Washington park to cost $150,000. F. Schumacher, secretary park board, City Hall.

SHEBOYGAN, WIS.—The city commissioners are planning to install a 300-horsepower high pressure boiler and 12,000,000-gallon high duty pump.

SOUTH MILWAUKEE, WIS.—The Bucyrus Co. will build a 1-story forge shop, 70 x 150 feet.

NEVADA, IA.—Nevada Truck & Tractor Co. will establish a plant at Nevada.

MINNEAPOLIS.—The Minneapolis Steel & Machinery Co., Twenty-ninth and Minnehaha streets, will build a 1-story factory, 140 x 356 feet, costing $60,000.

MONTEVIDEO, MINN.—The Moyer Mfg. Co. will build an addition to its machine shop and garage.

ST. PAUL.—The Foltz Engineering Co., 1410 Pioneer building, is preparing plans for a 10-story concrete elevator, 48 x 150 feet, for the Equity Co-operative Exchange, to cost $125,000.

SOUTHERN STATES

HESSON, MISS.—An election will be held soon on issuing $18,000 in bonds for a water works and electric light plant.

UTICA, MISS.—The city council has engaged Xavier A. Kramer, Magnolia, Miss., to prepare plans for an electric light plant and for reconstruction of the water works pumping station.

OAKDALE, LA.—Xavier A. Kramer, Magnolia, Miss., engineer, has been retained to prepare plans and specifications for a water works system. R. E. L. Ricketts is secretary water works commission.

CORPUS CHRISTI, TEX. — The Kelley Mfg. Co. has been incorporated; $50,000 capital stock; by M. R. Kelly, C. J. Boothrod and W. E. Pope.

MARLIN, TEX.—The county court has been petitioned by W. N. Moore, county commissioner, Regan, Tex., to build a 110-foot steel span to replace a bridge recently destroyed.

HAMBURG, ARK.—Ashley county court has appropriated $16,000 for two steel bridges to be erected soon.

CHATTANOOGA, TENN.—C. E. James will build a hydro-electric power plant on Middle creek. Preliminary work has been started.

CLEVELAND, TENN. — The Hardwick Stove Co. will double the capacity of its plant.

FAYETTEVILLE, TENN.—The Robinson-McGill Co., of Nashville, Tenn., has purchased a factory site and will erect a building for the manufacture of carriages.

WESTERN STATES

ARGENTINE, KAS.—The Santa Fe railroad is preparing plans for an addition to its car repair shop to cost $45,000.

WICHITA, KAS.—The Standard Oil Co., M. M. Van Keuren, local manager, has approved plans for buildings to cost $75,000, including a warehouse, iron barrel wash house, garage, wagon shop and stables.

BROADVIEW, MONT.—Plans for a water works system have been approved by county commissioners and a contract will be let soon for a plant to cost $30,000.

BUTTE, MONT.—The engineers of the Anaconda Copper Co. are preparing plans for the construction of a 5,000-ton plant at the Boston & Montana works at Great Falls. Plans call for completion of installation next year.

MILES CITY, MONT.—The county commissioners have awarded the Security Bridge Co., Billings, Mont., a contract for the construction of a steel bridge over Fallon creek.

LOS CRUCES, N. M.—Two steel bridges, each consisting of five spans 90 feet long, are to be constructed in Dona Ana county. J. W. Johnson, state highway engineer, Santa Fe.

BOISE, IDA.—The Lucky Boy Mining Co., operating a mine by the same name 6 miles northwest of Idaho City, will increase the capacity of its mill from 25 to 70 tons per day. A 1,000-horsepower De La Vergne crude oil engine direct connected to a 55-kilowatt, 250-volt generator has been purchased and installation will be made shortly.

BOISE, IDA.—The county commissioners have awarded the Missouri Valley Bridge & Iron Co., Denver, Colo., a contract for construction of a 450-foot steel highway bridge over the Snake river in Grand View valley.

GRANGEVILLE, IDA. — J. C. Fox has bonded his property in the Marshall Lake mining district and has had plans prepared for the erection of a 25-stamp mill.

IDAHO FALLS, IDA.—Reinforced concrete and steel headgates will be installed by district No. 16. Local engineer in charge of the work is Dan Martin.

MULLAN, IDA.—E. B. Crawford, president of the Reindeer Queen Mining Co., will build a 75 to 100-ton stamp mill on his property.

NAMPA, IDA.—The Oregon Short Line railroad has selected a site at Nampa and will erect a roundhouse estimated to cost about $25,000.

ONEIDA, IDA.—Work will be started soon on an addition to the electric plant of the Utah Power & Light Co., Salt Lake City, on Bear river, costing $250,000.

PORT ORCHARD, WASH.—The Paulsbo Light & Power Co. has been granted a franchise to construct and operate a power plant and all lines in all portions of the county.

RIDGEFIELD, WASH.—Citizens have voted in favor of a water works system costing $11,000.

RITZVILLE, WASH.—H. B. Spear has petitioned for a franchise for the Ritzville Central Heating Co. to furnish heat and electric power.

SEATTLE, WASH. — The Seattle Cedar Lumber Co. has been granted a permit to erect $20,000 brick and steel crematory. The Seattle Boiler Works, 1132 West Forty-fifth street are the builders.

SPOKANE, WASH.—The American Bridge Co. has been awarded a contract by the Northern Pacific railroad for steel to be used in the grade elimination bridges at Spokane.

TYLER, WASH.—Harry E. Elrod, engineer, Dallas, is preparing plans for a water works system to cost $250,000.

WINLOCK, WASH.—J. A. Vaness has awarded Louis Livingstone a contract for the erection of a sawmill to replace plant damaged by fire recently. This mill will have a daily capacity of 100,000 feet.

PORTLAND, ORE.—The city and the Southern Pacific railroad have agreed on a steel bridge consisting of four spans, each 75 feet on Holgate street. W. Hood, chief engineer, San Francisco, is in charge.

BERKELEY, CAL.—California Corrugated Iron Works, Fifth and Parker street, is doubling its capacity at a cost of $10,000.

LOS ANGELES, CAL.—The Cochise Machine Co., 404 Aliso avenue, will build a plant to manufacture rock and hand drills and other mining machinery.

LOYALTON, CAL.—The city is to install a municipal electric light plant costing $5,000.

SACRAMENTO, CAL.—Bids will be received until Nov. 29 by the California state highway commission, Forum building, for a plate girder bascule bridge over Yolo bypass. W. R. Ellis is secretary of the commission.

Want Cranes

The Bethlehem Steel Co., South Bethlehem, Pa., is in the market for a large number of additional cranes, including one crane with a capacity of 150 *tons.*

The American Smelting & Refining Co., New York, is in the market for two 10*-ton cranes for installation at its plant at Perth Amboy, N. J.*

The New York Central railroad is in the market for a 15*-ton locomotive crane.*

The Erie railroad is in the market for a locomotive crane to handle a 2-cubic yard bucket.

The Maryland Steel Co., Sparrows Point, Md., is in the market for three 10*-ton cranes for its marine department.*

The American Sheet & Tin Plate Co., Pittsburgh, is receiving bids for ten electric traveling cranes.

The Roy C. Whayne Supply Co., Lincoln building, Louisville, Ky., is in the market for a locomotive crane or traveling derrick car with 70*-foot boom.*

HAWAIIAN TERRITORY

PEARL HARBOR, H. T.—Bids will be received until Nov. 27 by the bureau of docks and yards, navy department, Washington, D. C., for the construction of a reinforced concrete power house and operating building at Pearl Harbor.

CANADA

CHATHAM, ONT.—The Gray-Dort Motors Co. has been incorporated to manufacture automobiles; $500,000 capital stock; by Robert Gray and William M. Gray, of Chatham, and Josiah D. Dort, of Flint, Mich.

OTTAWA, ONT.—The Yukon Copper Co. has been incorporated to carry on mining and smelting; $200,000 capital stock; by Wilbur D. Greenough, of White Horse, Yukon, Alfred Thompson, Dawson and James F. Smeltie.

ST. CATHERINES, ONT.—The Confederation Sand & Gravel Co. has been incorporated to carry on business as quarrier; $20,000 capital stock; by William H. Hutchinson and Mary S. Frible, St. Catharines, and William B. Russell, Toronto.

TORONTO, ONT. — The Utilities Equipment Co., Ltd., has been incorporated to manufacture electrical appliances; $40,000 capital stock; by William Davidson, John C. MacFarlane and Alex McKenzie.

TORONTO, ONT.—The Ontario Aeroplane Co., Ltd., has been incorporated to manufacture aeroplanes; $200,000 capital stock; by Jacob W. Broudy, William R. Bird and William L. Holmes.

MONTREAL, QUE.—The Transcona Shell Co., Ltd., has been incorporated to manufacture shells and munitions; $50,000 capital stock; by Francis G. Bush, George R. Brennan and Michael J. O'Brien.

MONTREAL, QUE.—The Central Engineering Co. has been incorporated to manufacture machinery and tools; $25,000 capital stock; by Thomas Arnold and Arthur W. Horsey, of Longueil.

ROXTON FALLS, QUE.—The Roxton Falls Mfg. Co. has been incorporated to manufacture metal and wooden articles and munitions; by Oscar Fauteux, Joseph A. Desmarteau and Hector Fauteux, of Verdun, Que.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery April 1.)

Bessemer, valley	$17.00
Bessemer, Pittsburgh	17.95
Basic, Pittsburgh	16.95
Basic, eastern Pa.	17.75 to 18.00
Malleable, Pittsburgh	16.95
Malleable foundry, Chicago	17.50
Malleable foundry, Philadelphia	17.25 to 17.75
Malleable foundry, Buffalo	16.50
No. 1X foundry, Philadelphia	16.75 to 17.00
No. 2 foundry, Pittsburgh	16.95
No. 2 fdy., first half, Pbgh.	15.95 to 16.45
No. 2 foundry, first half, valley	15.00 to 15.50
No. 2 foundry, Cleveland	16.80
No. 2 foundry, Ironton	16.50
No. 2 foundry, Chicago	17.50
No. 2X foundry, Philadelphia	17.00 to 17.25
No. 2X fdy., N. J. tidewater	17.00 to 17.25
No. 2X foundry, Buffalo	16.50
No. 2 plain, Philadelphia	16.25 to 16.50
No. 2 plain, N. J. tidewater	16.50 to 17.00
No. 2 plain, Buffalo	16.00
No. 2 southern, Birmingham	13.00 to 13.50
No. 2 southern, Cincinnati	15.90 to 16.40
No. 2 southern, Chicago	17.00 to 18.00
No. 2 southern, Phila. delivery	17.00 to 17.50
No. 2 southern, Cleveland	17.00 to 17.50
No. 2 south'n, New York docks	17.00 to 17.50
No. 2 southern Boston, docks	16.25 to 16.75
No. 2 south. interior, New Eng.	18.00 to 19.00
No. 2 southern, St. Louis	15.90
Virginia No. 2X furnace	14.50 to 15.00
Virginia 2X, Philadelphia	16.75 to 17.25
Virginia 2X, Jersey City	17.50 to 17.85
Virginia 2X, Boston points	17.75 to 18.25
Gray forge, eastern Pa.	15.75 to 16.00
Gray forge, Pittsburgh	15.95 to 16.45
Gray forge, Birmingham	10.50
Silveries, 8 per cent, Jackson, O.	22.00 to 23.00
Silveries, 5 per cent Birmingham	13.25 to 13.50
Silveries, 8 per cent, Chicago	20.00 to 20.50
Standard low phos., Phila.	28.50 to 29.00
Lebanon low phos., furnace	25.00
Low Phos., Pittsburgh	29.00 to 29.50
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	17.25 to 17.75
Charcoal, Buffalo	18.00 to 19.00
Charcoal, Birmingham	21.50

IRON ORE

Lake Superior Ores.
(Lower Coke Reports.)

Old range Bessemer, 55 per cent	$3.75
Mesabi Bessemer, 55 per cent	3.45
Old range, non-Bess., 51½ per cent	3.00
Mesabi non-Bessemer, 51½ per cent	2.80

Foreign Ores.
(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent	8 to 8½
For'n non-Bess., 50 to 65 per cent	8 to 8½

COKE

(At the ovens.)

Connellsville furnace	$2.35 to 2.50
Connellsville fur., first half	2.35 to 2.50
Connellsville foundry	3.00 to 3.25
Connellsville fdy. contr.	3.00 to 3.25
Wise county furnace	2.75 to 3.00
Wise county foundry	3.00 to 3.25
Pocahontas furnace	2.75 to 3.00
Pocahontas foundry	3.00 to 3.25
New River, foundry	3.25 to 3.75
New River, furnace	3.00 to 3.25

FERRO ALLOYS AND STEEL MAKING METALS

Ferro mang., delivered (prompt)	98 to 100
Ferro mang., Balti., (future)	100.00
Spiegeleisen 20 per cent, furnace	28.00
Ferro-silicon, 50 per cent, Pbgh.	83.00 to 85.00
Ferro-silicon, 50 per cent, Phila.	85.00 to 87.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, 24.00; 10 to 11 per cent, $25.00; 11 to 12 per cent, $26.00; 12 to 13 per cent, $27.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-chrome, 4 to 6 per cent carbon, 25 cents per pound; 2 per cent carbon, 45 cents per pound, delivered.

Ferro-vanadium, $3.15 per pound of contained alloy, Pittsburgh.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

Nickel. 50 to 55 cents per pound.

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.40
From Pittsburgh	.619
From Youngstown	.619
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

Ferro-tungsten, nominal.

Cobalt metal, nominal, Pittsburgh.

Aluminum, 55 to 56 cents per pound, New York.

Ferro-molybdenum, Pittsburgh, nominal.

SEMI-FINISHED STEEL

Open hearth billets, Phila.	$32.00 to 34.00
Bessemer billets, Phila.	28.00
Forging billets, Phila.	40.00 to 50.00
Forging billets, Pbgh.	40.00
Forging billets, Chgo.	32.00 to 34.00
Wire rods, Pittsburgh (nom.)	35.00 to 37.00
Bess. bill., Youngstown	28.00
Open hearth billets, Youngstown	28.00 to 30.00
Bessemer billets, Pittsburgh	28.00
Open hearth billets, Pittsburgh	28.00
Bess. sheet bars, Youngstown	28.00 to 30.00
Op. h'th sheet bars, Youngstown	28.00 to 30.00
Bess. sheet bars, Pittsburgh	28.00 to 30.00
Op. h'th sh. bars, Pbgh.	28.00 to 30.00
Muck bar, Pittsburgh (nominal)	30.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh. & Chg.	1.25c
Stand. op-h'th rails, Pbg. & Chg.	1.34c
Light rails 8 to 10 lbs., Pbgh.	1.60c
Light rails, 8 lb. Chgo.	1.49c
Light rails 12 to 14 lbs. Pbgh.	1.55c
Light rails, 12 lbs. Chgo.	1.44c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—

Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18

Buffalo to:—

Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brookyln (by canal)	1.25 to 1.60

Virginia furnaces to:—

Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88

Birmingham, Ala., to:—

Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75

Chicago to:—

Des Moines	$2.80
Milwaukee	.50
Moline, Ill	1.40
Omaha	3.58
St. Louis	1.58

Ironton and Jackson, O., to:—

Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails 16 to 20 lbs., Pbgh.	1.50c
Light rails 16 to 20 lbs., Chgo.	1.39c
Light rails 25 to 45 lbs., Pbgh.	1.45c
Light rails 25 to 45 lbs., Chgo.	1.34c
Relaying rails, standard, Pbgh. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chgo.	21.50 to 22.50
Angle bars, st. sect., Pbgh. base.	1.50c to 1.75c
Angle bars, st. sections, Chicago	1.50c to 1.75c
Spikes, railroad, Pbgh.	1.85c
Spikes, railroad, Chgo.	1.90c to 2.00c
Track bolts, Pbgh.	2.25c
Track bolts, Chgo.	2.40c to 2.50c
Tie plates, Chgo.	34.00 to 35.00

SHAPES, PLATES AND BARS

Structural shapes, Pbgh.	1.70c to 2.00c
Structural shapes, Chgo.	1.79c to 1.99c
Structural shapes, Philadelphia	1.759c to 1.859c
Structural shapes, New York	1.769c to 1.869c
Struc. shapes, San Francisco	2.00c to 2.05c
Tank plates, Chgo.	1.79c to 1.99c
Tank plates, Pittsburgh	1.70c to 2.00c
Tank plates, Philadelphia	1.759c to 1.859c
Tank plates, New York	1.769c to 1.869c
Bars, soft steel, Pittsburgh	1.70c to 2.00c
Bars, soft steel, Chgo.	1.79c to 1.99c
Bars, soft steel, Philadelphia	1.759c
Bars, soft steel, New York	1.769c
Hoops, carloads, Pittsburgh	1.75c
Bands, Pittsburgh	1.60c
Shafting, Pbgh., contr. carloads	55 off
Bar iron, Chgo.	1.45c to 1.55c
Bar iron, Philadelphia	1.709c to 1.759c
Bar iron, New York	1.719c to 1.769c
Bar iron, Cleveland	1.55c to 1.65c
Bar iron, Pittsburgh	1.60c
Hard steel bars, Chicago	1.60c
Smooth fin., mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	2.20c to 2.35c
No. 28, black, Chgo.	2.44c
No. 28, tin mill, black, Pbgh.	2.15c to 2.30c
No. 28, galvanized, Pbgh.	3.90c to 4.00c
No. 28, galvanized, Chgo.	2.99c
No. 10, blue anld., Pbgh.	1.90c to 2.00c
No. 10, blue annealed, Phila.	1.959c to 2.009c
Tin plate, 100 lb., coke base	$3.60

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single pickled, cold roll, and re-anl.	30 cents
Hot roll'd pick'd and anl., tin mill	25 cents
Full pickl'd, cold rolled and re-anl.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller leveling	10 cents
Patent leveling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxiding	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free fr. mill scale	55 cents
Special open hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock.	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents

No reduction for sheets not annealed.

The above extras apply on both sheet and tin mill specification, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black. Butt-weld	Galv. Butt-weld
Steel, ⅜ to 3 inches	78	63½
Iron, ⅜ to 2½ inches	70	52
	Lap-weld.	
Steel, 2½ to 6 inches	77	62½

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	69
Iron, 3½ to 4½ inches l. c. l.	57

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotation.)

Wire nail jobbers, Pittsburgh	$1.90
Plain wire, jobbers, Pittsburgh	1.75
Galvanized wire, jobbers, Pbgh.	2.45
Polished staples, Pbgh.	2.05
Galvanized staples, Pbgh.	2.75
Barb wire, painted, jobbers, Pbgh.	2.05
Barb wire, galv., jobbers, Pbgh.	2.75

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled threads, 75, and 10; cut threads 75, and 5; larger or longer, 70.

Machine bolts with hot pressed nuts, ⅜ x 4 inches, smaller or shorter, rolled 75, 10, and 5; cut, 75, and 10; larger or longer, 70 and 5.

Gimlet and cone point lag bolts, 80.

Hot pressed square, blank or tapped nuts, $5.40 off list; hot pressed hexagon blank or tapped, $5.70.

Cold pressed square, blank or tapped, $4.80 off; hexagon, blank or tapped, all sizes, $6.25.

RIVETS

Structural rivets, Pbgh	2.25c
Structural rivets, Chgo. delivery	2.15c
Boiler rivets, Pbgh	2.35c
Boiler rivets, Chgo. delivery	2.25c

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.50c to 1.55c

COLD ROLLED STRIP STEEL

(Subject to regular extras.)

0.10 to 0.19 Carbon. 1½ inch and wider.	Base price Cut to length Hard.	Soft.
0.100 and thicker	3.35	3.60
0.050 to 0.099 inc.	3.45	3.70
0.035 to 0.049 inc.	3.60	3.85
0.031 to 0.034 inc.	3.95	4.25
0.025 to 0.030 inc.	4.10	4.50
0.020 to 0.024 inc.	4.30	4.70
0.017 to 0.019 inc.	5.20	5.70
0.015 and 0.016	5.60	6.10
0.013 and 0.014	6.45	6.95
0.012	7.05	7.55
0.011	7.40	7.90
0.010	7.75	8.25
	Coils.	
0.100 and thicker	3.25	3.50
0.050 to 0.099 inc.	3.30	3.55
0.035 to 0.049 inc.	3.45	3.70
0.031 to 0.034 inc.	3.60	4.00
0.025 to 0.030 inc.	3.70	4.10
0.020 to 0.024 inc.	3.80	4.20
0.017 to 0.019 inc.	4.00	4.60
0.015 and 0.016	4.50	5.00
0.013 and 0.014	5.20	5.70
0.012	5.55	6.05
0.011	5.90	6.40
0.010	6.25	6.75

CAST IRON WATER PIPE

Four-inch, Chicago	29.00
Six-inch and larger, Chicago	27.00
Six inch Class B, New York	26.00 to 26.50
Four-inch, Class B, New York	29.00 to 29.50
Four-inch, Birmingham	24.00
Six-inch and larger, Birmingham	22.00

Light weight water and gas pipe, $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	2.10c
Steel bars, 2-in. and over, Cleve.	2.50c
Steel bars, under 2-inch, Clevel'd	2.25c
Steel bars, Cincinnati	2.25c
Steel bars, Philadelphia	2.10c
Steel bars, New York	2.25c
Steel bars, St. Louis	2.15c
Steel bars, St. Paul	2.20c
Steel bars, over 2-inch, Buffalo	2.20c
Steel bars, Buffalo	2.20c
Iron bars, Chicago	2.10c
Iron bars, Cleveland	2.20c
Iron bars, St. Louis	2.05c
Iron bars, Cincinnati	2.10c
Iron bars, Philadelphia	2.10c
Iron bars, New York	2.00c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	2.20c
Shapes and plates, Cleveland	2.35c
Shapes and plates, Buffalo	2.30c
Shapes and plates, Cincinnati	2.20c
Shapes and plates, St. Louis	2.25c
Shapes and plates, Philadelphia	2.10c
Shapes and plates, New York	2.30c
Shapes and plates, St. Paul	2.30c
No. 10 blue anl. sheets, Chgo.	2.40c
No. 10 blue anl. sheets, Cleve.	2.40c
No. 10 blue an'l'd sheets, Buffalo	2.10c
No. 10 blue anl. sh. St. Louis	2.45c
No. 10 blue anl. sheets, Cinci	2.40c
No. 10 blue anl. sheet, St. Paul	2.45c
No. 28 black sheets, Chgo.	2.75c
No.28 black sheets, Cleveland	2.70c
No. 28 black sheets, Cincinnati	2.70c
No. 28 black sheets, St. Louis	2.65c
No. 28 black sheets, St. Paul	2.50c
No. 28 galv. sheets, Chgo.	4.35c
No. 28 galv. sheets, Cleveland	4.50c to 5.00c
No. 28 galv. sheets, Cincinnati	5.00c
No. 28 galvanized sheets, St. L.	4.85c

Freight Rates, Coke

Connellsville regions, per 2.000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.85
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

No. 1 railroad wrought, Chgo.	$13.00 to 13.50
No. 1 railroad wrought, Cleve.	14.00 to 14.50
No. 1 railroad wrought, St. L.	12.50 to 13.00
No. 1 railroad wrought, Cinci.	11.00 to 11.50
No. 2 railroad wrought, Chgo.	12.50 to 13.00
No. 2 railroad wrought, St. L.	12.50 to 13.00
Arch bars and transoms, Chgo.	15.75 to 16.25
Arch bars and transoms, St. L.	15.50 to 16.00
Knuckles, coup., Chgo.	13.50 to 14.00
Springs, Chgo.	14.00 to 14.50
Knuckles, coup. & spr'gs, St. L.	12.00 to 12.50
Shafting, Chgo.	15.00 to 15.50
Shafting, St. Louis	15.00 to 15.50
Steel car axles, Chicago	19.50 to 20.00
Steel car axles, St. Louis	20.50 to 21.00
Locomotive tires, Chicago	12.50 to 13.00
Locomotive tires, St. Louis	14.00 to 14.50
Cut forge, Chicago	12.25 to 12.75
Pipes and flues, Chicago	9.75 to 10.50
Pipes and flues, Clevel'd (nom.)	10.50 to 11.00

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—	
New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, (all rail)	73.9 cents
Pacific coast, (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Pipes and flues, St. Louis	9.50 to 10.00
No. 1 cast, Chicago	11.75 to 12.25
No .1 cast, Cleveland	12.00
No. 1 cast, Cincinnati	10.50 to 11.00
No. 1 cast, St. Louis	9.50 to 10.00
No. 1 busheling, Chicago	10.75 to 11.25
No. 1 busheling, Cleveland	12.50 to 12.75
No. 1 busheling, Cincinnati	9.00 to 9.50
No. 1 busheling, St. Louis	10.50 to 11.00
No. 2 busheling, Chicago	7.75 to 8.25
No. 1 boiler plate, cut, Chgo.	9.50 to 10.00
No. 1 boiler plate, cut, St. L.	7.00 to 7.50
Boiler punchings, Chicago	12.00 to 12.50
Cast borings, Chicago	6.75 to 7.25
Cast borings, Cleveland	7.00 to 7.25
Cast borings, Cincinnati	6.75 to 7.25
Cast borings, St. Louis	7.00 to 7.50
Machine shop turnings, Chgo.	7.25 to 7.75
Machine shop turnings, Cleve.	6.00 to 6.50
Machine shop turnings, Cinci.	$ 6.50 to 7.00
Machine shop turnings, St. L.	8.00 to 8.50
Malleable agricultural, Chgo.	9.50 to 10.00
Malleable agriculture, St. Louis	9.00 to 9.50
Malleable railroad, Chicago	12.00 to 12.50
Malleable, Cincinnati	7.25 to 7.75
Malleable railroad, St. Louis	11.00 to 11.50
Angle bars, iron, Chicago	15.00 to 15.50
Angle bars, iron, St. Louis	14.00 to 14.50
Angle bars, steel, Chicago	13.00 to 13.50
Angle bars, steel, St. Louis	12.00 to 12.50
Stove plate, Chicago	9.75 to 10.00
Stove plate, Cleveland	9.00 to 9.25
Stove plate, Buffalo	9.00 to 9.50
Stove plate, Cincinnati	7.00 to 7.50
Stove plate, St. Louis	9.00 to 9.50
Bundled sheet, Cincinnati	7.00 to 7.50

(Gross tons.)

Heavy melting steel, Pbgh.	$15.50 to 16.00
Heavy melting steel, Buffalo	14.50 to 15.00
Heavy melting steel, Chicago	12.50 to 13.00
Heavy melting steel, Cleveland	13.75 to 14.25
Heavy melting steel, Cincinnati	11.50 to 12.00
Heavy melting steel, eastern Pa.	14.50 to 15.00
Heavy melting steel, New York	12.50 to 12.75
Heavy melting steel, St. Louis	13.50 to 14.00
Grate bars, Buffalo	10.50 to 11.00
Grate bars, New York	7.75 to 8.00
No. 1 railroad wrought, east. Pa.	16.00 to 16.50
No. 1 railroad wrought, Pbgh.	15.00 to 15.50
No. 1 R. R. wrght., New York	14.75 to 15.00
No. 1 R. R. wrought, Buffalo	13.50 to 14.00
Shafting, New York	16.00 to 16.50
Shafting, eastern Pa.	18.00 to 18.50
Wrought pipe, New York	11.50 to 11.75
Wrought pipe, eastern Pa.	13.50 to 13.75
Mch. shop turnings, New York	8.25 to 8.50
Machine shop turnings, Buffalo	6.50 to 7.00
Heavy axle turnings, Buffalo	11.00 to 11.50
Mch. shop turnings, Pbgh.	9.00
Mch. shop turnings, eastern Pa.	10.00 to 10.25
Cast borings, New York	8.25 to 8.50
Cast borings, eastern Pa.	10.25 to 10.50
Cast borings, Buffalo	7.50 to 7.75
Cast borings, Pittsburgh	9.75 to 10.00
Stove plate, N. J. points	10.50 to 10.75
Stove plate, Pittsburgh	9.00 to 9.75
Stove plate, eastern Pa.	10.50 to 11.00
Shoveling steel, Chicago	13.75 to 14.25
Shoveling steel, St. Louis	12.50 to 13.00
Reroll. rails, 5 ft. & ov., Pbgh.	15.50 to 16.00
Reroll. rails, 5 ft. & ov., Chgo.	14.50 to 15.00
Reroll. rails, 5 ft. & ov., Cleve.	14.50 to 14.75
Reroll. rails, 5 ft. & ov., E. Pa.	15.75 to 16.25
Reroll. rails, 5 ft. & ov., St. L.	15.00 to 16.00
Steel rails, short, Chicago	14.50 to 15.00
Steel rails, short, Cleveland	17.00
Steel rails, short, St. Louis	13.50 to 14.00
Iron rails, Cleveland nom.	15.00 to 15.50
Iron rails, Chgo.	15.50 to 16.00
Iron rails, Buffalo	16.00 to 16.50
Iron rails, Cincinnati	11.75 to 12.25
Iron rails, St. Louis	14.00 to 14.50
Frogs, switches, guards, Chgo.	14.00 to 14.50
Frogs, switches, guards, St. L.	12.75 to 13.25
Car wheels (iron), Pittsburgh	13.25
Car wheels (steel), Pittsburgh	17.00 to 17.50
Car wheels, Chicago	12.50 to 13.00
Car wheels, eastern Pa.	14.00 to 14.50
Car wheels, Buffalo	13.50 to 14.00
Car wheels, N. Y.	11.50 to 12.00
Car wheels, St. Louis	13.00 to 13.50
Iron axles, Pittsburgh	20.00 to 21.00
Iron axles, Cincinnati	20.25 to 20.75
Iron axles, eastern Pa. (nom.)	23.00 to 24.00
Iron axles, Chicago	21.00 to 21.50
Iron axles, Buffalo	20.00 to 20.50
Iron axles, St. Louis	15.00 to 15.50
Steel car axles, New York	19.00 to 20.00
Steel car axles, Buffalo	19.50 to 20.00
Steel car axles, Cleveland	22.00
Steel car axles, eastern Pa.	20.00 to 21.00
No. 1 busheling, Buffalo	11.00 to 11.50
No. 1 busheling, Pittsburgh	9.75 to 10.00
No. 2 busheling, Buffalo	9.50 to 10.00
Low phos. steel, Buffalo	18.50 to 19.00
Low phosphorus steel, Pbgh.	19.50 to 20.00
Low phos. steel, eastern Pa.	20.00 to 20.50
No. 1 forge, eastern Pa.	12.00 to 12.50
No. 1 cast, eastern Pa.	14.00 to 15.00
No. 1 cast, Pittsburgh	13.50 to 14.00
No. 1 heavy cast, N. J. points	12.75 to 13.00
Mall. railroad, Cleveland	14.00 to 14.50
Malleable railroad, Pittsburgh	13.50 to 13.75
Malleable railroad, Buffalo	13.50 to 14.00
Malleable railroad, eastern Pa.	10.50 to 11.00
Bundled sheet, Pittsburgh	12.50 to 12.75
Bundled sheet, Cleveland (nom.)	12.00
Bundled sheet, Buffalo	10.50 to 11.00
No. 1 R. R. and mch. cast, Bfl.	13.75 to 14.25
Boiler plate sheared, Buffalo	13.00 to 13.50

COLD DRAWN AND PRESSED SHAPES

Pressed Drawn

SPECIAL SMALL ANGLES, CHANNELS ARCHITECTURAL MOULDINGS FORMED OF FULL-PICKLED, FULL COLD-ROLLED OPEN-HEARTH STEEL AND NON-FERROUS METALS.

INTERIOR METAL MANUFACTURING CO.
JAMESTOWN, N. Y.
SEND FOR CATALOGUE M. AGENTS IN PRINCIPAL CITIES

SHEAR BLADES
For Your Own Sake, Try Them Once at Least

NOT A DEFECTIVE BLADE IN OVER TWO YEARS
The L. & I. J. WHITE CO., 15 Columbia St., Buffalo, N. Y.

The C. & G. Cooper Co. Mt. Vernon, Ohio
ENGINE BUILDERS
CORLISS ENGINES 50 to 10,000 H. P.
GAS ENGINES 200 to 3000 H. P.
82 YEARS OF EXPERIENCE

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The Name "NATIONAL" PIPE

AT THE PANAMA-PACIFIC EXPOSITION
In the next announcement (November 25th) the reader will be given a brief glance at some of the "NATIONAL" Tubular and Allied Products which secured THE GRAND PRIZE at the Exposition. Don't fail to look for it!
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Developing an Acid-Resisting Alloy

(*Continued from page 991*)

results as obtained on a representative sample, which would appear to be the best means of indicating the general composition and type of the alloy, were as follows:

Copper	6.42
Manganese	0.98
Silicon	1.04
Tungsten	2.13
Nickel	60.65
Aluminum	1.09
Iron	0.76
Chromium	21.07
Molybdenum	4.67
Total	98.81

(Carbon and boron not determined.)

The casting of the alloy proved to be quite as serious a problem as the development of the composition. The melting point is approximately 1,300 degrees Cent. The furnace must be capable of readily attaining the temperature of molten nickel, say 1,600 degrees. When thoroughly liquid, the alloy pours readily and fills the mold perfectly, but the freezing point is so quickly reached that feeding of the casting from risers, to make up for shrinkage, is practically impossible. Moreover, the shrinkage is so excessive that cracks and hollow spots are difficult to avoid. This feature can be perhaps better appreciated when it is noted that the most important instrument in mind for use of the alloy was a calorimeter bomb, which consists essentially of a chamber of approximately 35 cubic inches, which must retain absolutely without leakage, a gas at an average pressure of 25 to 30 atmospheres. Here again the very complexity of the composition has probably been the chief factor in securing a metal which could by any means be cast in the dense, homogeneous form required. Fig. 2 shows the form of castings thus far undertaken. The lathe turnings, shown in Fig. 1, show fairly well the character and working properties of the metal. It works about the same as tool steel. The interior surfaces of the bomb and cover show no trace of corrosion after use in over 1,500 determinations, using the apparatus in determining the heating value of coals. In each determination is generated a considerable quantity of nitric and sulphuric acids, which condenses on the interior surfaces of the bomb. Under the prevailing conditions of heat and high oxygen pressure, the best possible conditions exist for the promotion of corrosive action.

Attempts to draw the alloy into wire and roll it into sheets have been only partially successful, but sufficient to show the likelihood of success when the conditions for proper annealing are better understood. The tensile strength of the cast metal is approximately 50,000 pounds per square inch. The name suggested for the alloy is "Illium".

The Chinese Machine Shop of Today

(*Concluded from Page 992.*)

mills, of from 10 to 20 looms, all hand or foot-driven, making a good quality of narrow, figured and plain cotton goods. Another industry that has interested me is that of making files by hand. These shops are numerous.

I hope the matter of equipping a Chinese technical school, with a good machine shop outfit, will not be forgotten when there comes a sufficient lull in war orders, and that it will be before the British get in their offer. There can be little doubt but that such a gift will be the best form of advertising that could be undertaken. If the time ever comes, I shall be glad to do what I can to place

it well. It seems hardly propitious for establishing agencies here just at the present time, on account of various conditions caused by the war. There are several firms which undertake to take orders for American machinery, but they do not keep any stock or samples on hand. What is really needed here is facility for showing the goods and demonstrating the machines. It will go a great way towards filling the order book. What is necessary is to get the goods in the front window where everybody can see them.

The country which is best prepared for eventualities wins out in this race. It is up to the Americans to decide whether they will let this opportunity slip through their fingers or not.

The Russian Manganese Industry

The year 1914 opened unfavorably for the manganese industry in the Russian Caucasus. The foreign demand for ore during the first five months of the year was much below the demand for the corresponding period of 1913, and the increeased cost of production due to the strikes in July and August, 1913, made it difficult to compete with Indian prices. The demand, however, increased in May and continued increasing until early in August, when an embargo was placed on shipments of ore. The following figures show the exports of manganese ore from the Caucasus during the last five years and the growing tendency to ship from Batum rather than from Poti:

Ports.	1910 Tons.	1911 Tons.	1912 Tons.	1913 Tons.	1914 Tons.
Batum	36,215	129,233	308,373	420,900	312,129
Poti	364,500	442,460	634,200	649,780	415,016
Total	400,715	571,693	942,573	1,079,680	727,145

The value of shipments of manganese ore to the United States during the last five years was as follows: 1910, $259,898; 1911, $197,737; 1912, $521,791; 1913, $658,987; 1914, $199,923.

The average prices of manganese ore per long ton (2,240 pounds) during 1914 were as follows: January to July—ordinary ore (48 per cent), $2.24, washed metallic ore (52 to 53 per cent), $2.87, peroxide (85 to 88 per cent), $4.48; July to December 31—ordinary ore, $1.46, washed metallic ore, $1.60, peroxide, $3.02. The stock on hand at Batum, Tchiatouri and Poti at the close of 1914 is estimated at 1,600,000 tons.

Japanese Coal in Manchuria

The total imports of coal into North Manchuria, principally to Harbin, during 1914 amounted to 69,437 tons, of which 58,830 tons were imported from South Manchuria by the Japanese; while the remainder of 10,607 tons was imported from the Ussuri district by the Russians. It may be of interest to explain here why the bulk of the coal used in North Manchuria is Japanese instead of Russian, especially as Russian coal is of better quality and located 87 miles nearer to Harbin, the main point of consumption and distribution. It costs but from $0.86 to $1.14 per ton to load Japanese coal into the cars at the mines, and as these are under the control of the South Manchuria Railway it is said that coal is freighted to Changchun free. It costs from $2.28 to $2.57 per ton to place Russian coal on the cars at the mines; it must then pay $0.57 per ton for transportation by narrow-gauge line to the main railway, and the freight from there to Harbin is $1.71 per ton. Thus it costs, on an average, $4.70 to deliver a ton of Russian coal at Harbin, whereas with an average cost of production of $1 per ton at the mines, Japanese coal can be delivered at Harbin at a cost of $2.71 per ton.

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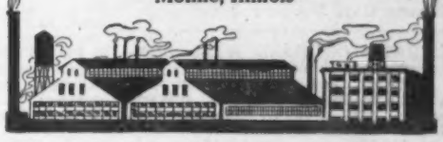

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